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WATER PLANT OPTIMIZATION STUDY
PORT DOVER WATER TREATMENT PLANT

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Please note that some of the recommendations contained in this report may have already been completed at time of publication. For more information, please contact the local municipality, or the Water Resources Branch of the Ministry of Environment and Energy.

Note, all references to Ministry of the Environment in this report should read Ministry of Environment and Energy.

WATER PLANT OPTIMIZATION STUDY

PORT DOVER WATER PURIFICATION PLANT

Summary of Findings and Recommendations

This Water Plant Optimization Study (WPOS) was initiated by the Ministry of the Environment (M.O.E.) to review the operating conditions over a 3-year study period and determine an optimum treatment strategy for contaminant removal at the Port Dover Water Treatment Plant. This optimization study is part of the on-going Drinking Water Surveillance Program (DWSP) which has been implemented to provide a continuously updated database on Ontario drinking water quality.

The Port Dover Water Treatment Plant has generally produced drinking water which met the Ontario Drinking Water Objectives in terms of both turbidity removal and disinfection; however, the data base available for the 3-year study period was not complete.

The following recommendations are made in an effort to optimize plant performance:

Studies

- Conduct a Filter Media Study to determine media characteristics, media intermixing, and efficiencies of the backwash process.
- Review the existing chlorination systems to determine the optimum chlorine application points and additional residual monitoring equipment required.
- Standard operating procedures and reporting forms should be developed and provided to all plant operators.
- Conduct a plant flow audit and calibrate all flow meters on a routine basis.
- Prepare a Detailed Plant Process and Piping Diagram.
- A detailed plan should be developed to automate the water plant operation.

- Install surface wash facilities on the old filters at the water plant.

- Install rate of flow control on the filters.

- Provide backwash rate control for the old filters.

- A detailed study of the Doan's Hollow Infiltration Gallery should be undertaken to confirm its continued use as a source of water and identify protection measures for the drainage area as well as process modifications.

Plant Modifications

- Install a streaming current monitor to assist in determining optimum coagulant dosage.

- Construct a proper chemical facility meeting current environmental and labour standards.

- Replace the gasoline powered generator with a stand-by diesel generator set for safety reasons.

- Install a valve to the intake to the new wet well to permit isolation of either section of the plant.

- Interconnect the two high lift discharge headers.

- Install a pH meter.

Other

- An emergency contingency plan should be developed for the Port Dover Water Treatment Plant. This plan should address emergency situations in the plant, including chemical spills.

- The existing access driveway has been identified as a potential hazard for chemical delivery trucks during the winter months and it should be upgraded and paved.

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INTRODUCTION


DOAN'S HOLLOW
BLUE LINE
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LAKE
CREEK
BLACK
RIVER
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WATER TREATMENT PLANT
LAKE ERIE
LEGEND
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ONTARIO MINISTRY OF THE ENVIRONMENT

PORT DOVER WATER TREATMENT PLANT OPTIMIZATION STUDY
MOE PROJECT NO. 7-2009

TERMS OF REFERENCE

The Drinking Water Surveillance Program (DWSP) of the Ontario Ministry of the Environment (M.O.E.) consists of a continuously updated base of information on Ontario water treatment plants and water quality. For each plant entering the program, a specific plant investigation and process evaluation study is required. The purpose of this study, the Water Plant Optimization Study (WPOS), is to document and review the existing operating conditions and to determine an optimum treatment strategy for contaminant removal at the plant. The Ministry of the Environment has prepared a detailed Protocol for the Water Plant Optimization Study which has been distributed to the Consultants engaged for the studies. This particular study for the Port Dover Water Treatment Plant has been conducted in accordance with the Protocol.

Introduction

The Port Dover Water Treatment Plant is located on Nelson Street near the intersection of Mergl Drive and Nelson Street in Port Dover as shown on Figure No. 1.

The limit of the service area is bordered by the hatched line as shown in Figure No. 1. The water supply to the service area is supplemented by a second source - the Doan's Hollow Infiltration Gallery. Doan's Hollow is located approximately 400 metres north of Hwy. No. 3 on Blue Line. The water system presently serves a base population of 4682 (1985) people. Two fish processing plants are the major industrial users in the area.

PLANT BACKGROUND

Water Plant

The Port Dover Water Treatment Plant was constructed in two stages. The original plant was built in 1954, and will be referred to in this report as the old plant. The expansion was constructed in 1976, and will be referred to as the new plant. Since that time there have been some additions, modifications and equipment replacements, but the majority of the plant is presently in the same form as constructed in 1976.

Doan's Hollow Infiltration Gallery

Doan's Hollow Infiltration Gallery was constructed in 1923 and was the only source of water for the former Town of Port Dover until the old plant was constructed in 1954. The Infiltration Gallery consists of a series of interconnected field tile which are fed from a natural stream and a man-made retention pond.

OPERATION OVERVIEW

Water Plant

The Port Dover Water Treatment Plant treats water from Lake Erie to produce potable water for system consumption. The major components of the plant are described in Section C of this report and are summarized as follows:

1. Intake
2. Screens
3. Low lift pumps
4. Clarifiers
5. Filters
6. Clearwell storage
7. High lift pumps

The operation of the plant is described in Section D.

Doan's Hollow Infiltration Gallery

Doan's Hollow Infiltration Gallery collects water through an infiltration system, which is then chlorinated before being pumped to the system. The main components are described in Section C of this report and the operation is described in Section D.

Sources of Information

The majority of information required for this study was supplied to Simcoe Engineering Group Limited by Region of Haldimand-Norfolk Operating Personnel. Data collected included information on water quantity, analyses of raw and treated water, and information on the existing intake, filters, etc. Information on the various components of equipment in the water treatment plant including pumps, generator, diesel engine and control equipment, etc. was also collected.

There have not been any studies conducted on the Port Dover Water Treatment Plant since the last expansion, although a study on the water distribution system was conducted in 1979.

SECTION A

RAW WATER SOURCE

SECTION A

RAW WATER SOURCE

A.1 GENERAL

A.1.1 Water Plant

The Port Dover Water Treatment Plant draws water from Lake Erie through a 500 mm (20") welded steel gravity intake pipe. The intake pipe extends 457 m (1500 ft.) into the lake.

The Appendix of this report provides a historical summary of data obtained from analyses conducted by the Ontario Ministry of the Environment on water samples taken at the Port Dover Water Treatment Plant for the period 1983 - 1985. On average raw and treated water samples were obtained quarterly - once in each of the four seasons. All samples collected for physical/chemical analysis were obtained by Ministry of the Environment staff. Raw water samples were grab samples taken at the shore.

During the study period 1983 - 1985, the general raw water quality parameters varied as follows:

Alkalinity	101-217 mg/L as $CaCO_3$
Aluminum	0.13 mg/L (only 1 sample analyzed for aluminum - May 1984)
Chloride	14-32 mg/L
Colour	2.5-27.0 TCU
Hardness	103.7-266.7 mg/L as $CaCO_3$
Field Temperature	0-24°C
Field Turbidity	0.18-30.10 FTU
Field pH	7.52-8.35

The general DWSP raw water quality parameters varied as follows:

Alkalinity	101.70-112.60 mg/L as $CaCO_3$
Aluminum	0.055-0.170 mg/L as Al
Chloride	15.0-17.5 mg/L
Colour	0.50-4.0 TCU
Hardness	129.50-137.50 mg/L as $CaCO_3$
Field Temperature	5.2-20.0°C
Field Turbidity	3.80-8.30 FTU
Field pH	7.90-8.30

Sections A.2, A.3, and A.4.2 refer to the quality of raw water at the water plant.

The Port Dover Water Treatment Plant has limited laboratory facilities to conduct on-site tests. The present equipment is limited to jar testing equipment, a finished water turbidimeter, a portable turbidimeter and a portable chlorine analyzer. A description of the equipment and frequency of testing is outlined in Section D.

A.1.2 Doan's Hollow Infiltration Gallery

Doan's Hollow Infiltration Gallery obtains its water supply from a tile bed fed by a natural spring fed stream and retention pond. The water from Doan's Hollow is chlorinated and pumped to the distribution system.

There were no water quality analyses conducted at Doan's Hollow during the period 1983 to 1985. Doan's Hollow was incorporated into the Drinking Water Surveillance Program (DWSP) in March of 1987.

The general DWSP raw water quality parameters varied as follows:

Alkalinity	196.2-202.6 mg/L as $CaCO_3$
Aluminum	0.04-0.10 mg/L
Colour	2.5-5.5 TCU
Hardness	261-279 mg/L as $CaCO_3$
Field Temperature	9.5-12.5°C
Field Turbidity	0.86-0.94 FTU
Field pH	7.3-7.6

For parameters having Ontario Drinking Water Objectives or desirable ranges, tests are within objectives, except for hardness and several colour values. As chlorination is the only treatment of the water from Doan's Hollow Infiltration Gallery, raw water quality results have been compared to drinking water objectives.

Sections A.4 and A.5.3 refer to the raw water quality at Doan's Hollow Infiltration Gallery.

A.2 CHEMICAL WATER QUALITY (Water Plant)

The chemical water quality parameters tested in the raw water during the study period 1983 to 1985 were: alkalinity, chloride, conductivity, hardness and pH.

In addition, the following raw water parameters were tested for in May 1984: fluoride, nitrate, sodium, aluminum, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, mercury, strontium, vanadium, and zinc.

The raw water alkalinity and hardness values vary substantially over the study period 1983 to 1985. Raw water alkalinity varied between 101 mg/L as $CaCO_3$ (July 1983) to 217 mg/L as $CaCO_3$ (August 1984). Raw water alkalinity values from the DWSP were between 101.7 mg/L as $CaCO_3$ (June 1987) to 112.6 mg/L as $CaCO_3$ (April 1987). The results for 1983 and 1985 are consistent with the DWSP results. It is not known why the 1984 results are substantially higher.

Raw water hardness ranged from 103.7 mg/L as $CaCO_3$ (April 1983) to 266.7 mg/L as $CaCO_3$ (August 1984), during the study period. Raw water hardness values from the DWSP varied between 129.5 mg/L as $CaCO_3$ (May 1987) to 137.5 mg/L as $CaCO_3$ (April 1987).

There are no facilities on-site for pH measurement. The Ministry of the Environment performs pH measurements on water samples on a quarterly basis. The results indicate that the pH is well within the Ontario Drinking Water Objectives desirable range of 6.5 to 8.5 and does not fluctuate significantly as evidenced in Table A-1.

TABLE A-1

PORT DOVER WATER TREATMENT PLANT
PH MEASUREMENT SUMMARY
1983 - 1985

	1983		1984		1985	
	Raw	Treated	Raw	Treated	Raw	Treated
Maximum	8.24	8.21	8.35	8.28	8.11	8.50
Minimum	8.12	8.02	7.52	7.71	8.06	7.74
Average	8.17	8.14	8.03	8.00	8.09	8.12

The raw water pH varied between 7.52 (April 1984) to 8.35 (January 1984) during the period of 1983 to 1985. The treated water pH varied from 7.71 (August 1984) to 8.50 (May 1985) during the same period. The raw water pH measurements correlate with the 1987 DWSP results.

Residual aluminum is normally measured when alum (hydrated aluminum sulphate) is used as a coagulant in the water treatment process. The Port Dover Water Treatment Plant uses poly-aluminum chloride, specifically SternPAC as supplied by Sternson for turbidity reduction. There are no Region of Haldimand-Norfolk records or Ministry of the Environment laboratory results that provide aluminum levels in the treated water during the study period 1983 to 1985. One raw water aluminum analysis was conducted in May 1984. The aluminum level was 0.13 mg/L. Aluminum testing was included as part of the DWSP. The DWSP results indicate that the raw water aluminum level varied between 0.055 mg/L (May 1987) and 0.170 mg/L (July 1987). The DWSP treated water aluminum level varied between 0.077 mg/L (March 1987) and 0.23 mg/L (July 1987).

Over the three year study period, the raw water chloride level varied between 14.0 mg/L to 32.0 mg/L, which is well within the Ontario Drinking Water Objectives of 250 mg/L. These values correlate with the 1987 DWSP results.

With the exception of iron and aluminum, all raw water parameters tested in May 1984, were at levels within the ODWO's and guidelines. Iron concentration in the treated water was within the ODWO limits. No treated water analysis was done for aluminum during 1983-1985.

A.3 PHYSICAL WATER QUALITY (Water Plant)

The palatability of drinking water to consumers is primarily dependent on colour, temperature, taste and odour, and turbidity. Turbidity is the general term given to silt, sediment, algae and other particulates in water that may shield microorganisms from a disinfectant. It is identified as a health related parameter by the MOE and the Ontario Drinking Water Objectives require that the turbidity of finished water leaving a water plant is not greater than 1.0 FTU.

The Appendix lists the physical Water Quality parameter levels in the raw and treated waters as measured by the Ontario Ministry of the Environment laboratories.

Table A-2 summarizes the raw water colour levels during the three year period between 1983 and 1985.

TABLE A-2

PORT DOVER WATER TREATMENT PLANT
COLOUR LEVELS SUMMARY
1983-1985

	1983 Raw Water	1984 Raw Water	1985 Raw Water
*Maximum	13.0	9.3	27.0
*Minimum	4.5	2.5	5.0
*Average	8.9	6.4	16.0

**All units in TCU*

There were eleven raw water and eleven treated water colour analyses conducted during the period of 1983 to 1985. The raw water colour varied from 2.5 TCU (August 1984) to 27.0 TCU (May 1985) during this period. The treated water colour varied from less than 0.4 TCU (January 1983) to 6.0 TCU (April 1984) during the same period. According to the Ministry of the Environment (Ontario Drinking Water Objectives), colour becomes aesthetically objectionable to an appreciable number of consumers at levels greater than 5 TCU. There were two cases from eleven samples where the reported treated water colour level exceeded the Ontario Drinking Water Objectives, (April and August 1984).

Although there are no on-site facilities available for colour level measurements, daily grab samples of raw water are taken and visually assessed for clarity, (i.e. good, fair or poor), and noted on Low Lift Plant Reports (Appendix 4). The samples are taken by operations personnel from the tap off the old low lift pump.

The temperature of the raw water is measured in the raw water wet well of the new low lift pumping station on a daily basis. The temperature of the raw water ranged between 0°C (32° F) during January of 1985 to a high of 24°C (75°F) during August of 1985.

There have been taste and odour complaints relating to the treated water. They occur during the summer months, usually the last week of July, or the beginning of August. The number of complaints are not recorded. Operations personnel estimate that on average, there are three to four incidents per year. The taste and odour problem is associated with algae growth due to warm water. During these periods, the chlorine dosage was increased and additional filter backwashes conducted to reduce the occurrence of taste and odour problems. The increase in chlorine dosage was not recorded and cannot be calculated. The number of backwashes was solely an operator's decision and the number of backwashes per day were not recorded.

The Appendix lists the Ministry of the Environment turbidity measurements and the operations personnel field turbidity measurement for the raw and treated water. The Ministry of the Environment test results for raw water turbidity levels varied between 1.09 FTU (January 1985) and 127 FTU (May 1985) during the study period based on a total of 11 tests. The plant was able to reduce the turbidity level to below acceptable limits except in two out of the eleven cases. The raw water field turbidity levels as measured by operations personnel varied between 0.18 FTU (February 1985) and 30.1 FTU (September 1984). The field records indicate the treated water turbidity levels were within the ODWO 335 out of 337 days (recorder out of service the other days) during 1984 and 56 days out of 56 days (analyzer was out of order the other 309 days) during 1985. The analyzer was out of order during 1986.

The Ministry of the Environment raw water samples were obtained at shore since the raw water had been chemically treated (pre-chlorination) in the wet well. The operations staff obtained raw water samples from the wet well. The grab samples were not representative of the water entering the wet well. Under normal conditions the water obtained had a low turbidity level. On occasion after a heavy storm, rainwater from the culvert adjacent to the plant carried very turbid water into the intake area. A strong easterly wind has also carried turbid river water toward the plant area. Plant records indicate that the plant was able to reduce turbidity levels to acceptable limits during these events.

A.4 CHEMICAL AND PHYSICAL WATER QUALITY (Doan's Hollow Infiltration Gallery)

It is difficult to assess the chemical and physical raw water quality as there are no test results during the study period 1983 - 1985. The DWSP results will form a sound basis to assess the raw water quality. The DWSP data base should cover a minimum one year period encompassing all four seasons

before definitive conclusions are drawn. From the available DWSP results, the raw water alkalinity of 196.2- 202.6 mg/L as $CaCO_3$ is within the acceptable ODWO range of 30 to 500 mg/L as $CaCO_3$ and the pH of 7.3 - 7.6 is in the desirable range for drinking water of 6.5 to 8.5. The raw water colour level varied between 2.5 - 5.5 TCU. The maximum desirable colour level is 5 TCU. The raw water hardness concentrations were in the order of 261-279 mg/L as $CaCO_3$ which exceeds the ODWO level considered as poor (200 mg/L as $CaCO_3$).

The land use surrounding Doan's Hollow Infiltration Gallery is agricultural, specifically tobacco farming. Operations personnel report that the Ministry of the Environment conducted analytical tests for Alachlor in 1985. Although the results are not available, the Region was advised that the Alachlor values were within acceptable levels.

A.5 MICROBIOLOGICAL WATER QUALITY

A.5.1 General

Bacteriological tests are done on a weekly basis by the Ministry of Health, London office for both the Port Dover Water Plant and Doan's Hollow Infiltration Gallery. The results are summarized in Table 7.0 of Appendix 3. Most Probable Number (MPN) tests are used to assess drinking water quality. The Ontario Drinking Water Objectives have established the unsafe water quality level for total coliform bacteria at a MPN of 5, while fecal coliforms should not be detected.

A.5.2 Water Plant

During 1986 there were 198 raw and treated water samples analyzed for total coliforms and 202 raw and treated water samples analyzed for fecal coliforms. The raw water samples were obtained in the new wet well. The treated water samples were obtained from the high lift discharge. The samples were obtained by operations staff and sent to the Ministry of Health laboratory in London, Ontario. The results are summarized in Table A-3.

TABLE A-3

SUMMARY OF BACTERIOLOGICAL TESTING (1986)
TOTAL COLIFORM

MPN	TOTAL COLIFORM Raw Number of Samples	MPN	FECAL COLIFORM Raw Number of Samples
Absent	24	Absent	92
1-100	70	2-10	3
101-5000	4	11-500	5
>5000	0	>500	0
Total Number of Samples	98		100

The results are affected significantly since pre-chlorine is applied in the wet well at times. In March 1987, the pre-chlorine application point for the old plant was moved to the discharge side of the old low lift pumps. At the same time, stainless steel sample taps were installed prior to pre-chlorination as part of the Drinking Water Surveillance Program (DWSP). From the 1987 DWSP results, the total coliform count (CT/100 mL) varied between 0 and 3200 while during the same period, the fecal coliform count (CT/100 mL) varied between 0 and 159.

A.5.3 Doan's Hollow Infiltration Gallery

The presence of raw water bacteriological indicators are pronounced at Doan's Hollow. The raw water samples were obtained from the intake well prior to chlorination. There were 30 samples out of 59 taken, where the MPN of total coliform exceeded 100 and 39 samples from 60 taken where the MPN of fecal coliform exceeded 10 as summarized in Table A-4. In all cases, the chlorination process was able to effectively reduce total coliform bacteria and fecal coliform to within the Ontario Drinking Water Objectives as discussed in Section F.

TABLE A-4

DOAN'S HOLLOW INFILTRATION GALLERY
SUMMARY OF BACTERIOLOGICAL TESTING (1986)

MPN	TOTAL COLIFORM Raw Number of Samples	MPN	FECAL COLIFORM Raw Number of Samples
Absent	0	Absent	2
1-100	29	1-10	19
101-5000	30	11-500	39
>5000	0	>500	0
Total Number of Samples	59		60

It is evident from the Ministry of Health results that the fecal coliform and total coliform bacteria of the raw water are significantly high. This would indicate the presence of human/animal waste in the source of drinking water.

A.6 RADIOLOGICAL WATER QUALITY

There were no tests conducted for radioactive parameters during the study period 1983 - 1985.

SECTION B

FLOW MEASUREMENT

SECTION B

FLOW MEASUREMENT

B.1 GENERAL

Based on the information supplied to Simcoe by the Regional Municipality of Haldimand-Norfolk staff, Tables 1.0 and 1.1 in Appendix 3 were prepared for the raw and treated water flows. The treated water daily flows in Table 1.1 for 1984 to 1986 include both the old and new high lift plant flows and Doan's Hollow flows in order to calculate the overall system demand. The 1985 raw water daily flows also include the Doan's Hollow flows, since it was necessary to compare the treated water flows to the raw water flows. Since the raw and treated flows for Doan's Hollow are equal, they would offset each other for the water plant flow comparison. The raw water flows for 1984 and 1986 are for the water plant only. We have broken the raw and treated water monthly summary in Tables 1.0 of Appendix 3 into flows from just the water plant and flows from just Doan's Hollow. Sections B.2 through to B.6 refer to flow measurement at the water plant and B.7 refers to flow measurement at Doan's Hollow. The flow metering equipment is summarized in Table B-1.

B.2 RAW WATER FLOW MEASUREMENT

B.2.1 General

The water plant is divided into two sections and the two units can operate independently. This section is divided into old plant flow measurements and new plant flow measurements.

B.2.2 Old Plant

Raw water flow for the old plant is based on low lift pump run time. There is no record of when the capacity of the pump was rechecked. The time of day, pump run time and the calculated flow are recorded once per day on a monthly log sheet.

B.2.3 New Plant

Raw water flow for the new plant is measured by a Foxboro Flow Meter - Model 14A and totalized. No chart recorder is included. The primary element in the unit is an orifice plate with a capacity range of 1728 m^3/d (264 igpm) to

TABLE B-1

FLOW METERING EQUIPMENT

FLOW	METHOD OF FLOW MEASUREMENT	TYPE	PRIMARY ELEMENT	CAPACITY RANGE (M^3/D)	CALIBRATION FREQUENCY	INSTRUMENTATION
Old Plant						
Low Lifts	Pump Run Time				Capacity has not been rechecked	
Clarifier	No Flow Measurement** Equipment Available					
Filters	No Flow Measurement Equipment Available					
Backwash	Pump Run Time					
High Lifts	Pump Run Time					
New Plant						
Low Lifts	Flowmeter	Foxboro	Orifice Plate	1728-17280	The unit has not been recalibrated since 1976	Local*
Clarifier	No Flow Measurement** Equipment Available					
Filters	No Flow Measurement Equipment Available					
Backwash	Based on Filter Volume as discussed in Section C					
High Lifts	Flow Meter	Kent	Veriflux Detector Head	1282-12820	This unit has not been recalibrated since 1976	Local*
Doan's Hollow Infiltration Gallery						
System Pump	Flow Meter	Neptune Trident	Turbine Rotor Dual Suspension	545-5448	This unit has not been recalibrated since 1986	Local*

*Integrator reading, total flow = (Integrator factor = 1) x (Integrator reading at end of period - Integrator reading 24 hours previous) = gallons/day

**Flow measurement is in low lift flow meter

17280 m^3/d (2644 igpm). The unit has not been recalibrated since its installation in 1976. The time of day, flow meter reading and flow are recorded once per day on a monthly log sheet.

B.3 CLARIFIER FLOW MEASUREMENT

B.3.1 General

There are no flow meters to measure clarifier outlet flows or the volume of sludge withdrawn from the clarifiers.

B.3.2 Old Clarifier

The old clarifier is "flushed" until clear water is produced. The operational procedure, number of sludge blowdowns, and length of time for sludge blowdown differs from operator to operator.

B.3.3 New Clarifier

The volume of sludge withdrawn from the new clarifier can be estimated since the sludge blowdown sequence is preset for 2 minutes every 90 minutes at a rate of 2.94 m/h (1 igpm/ft^2).

B.4 BACKWASH FLOW MEASUREMENT

B.4.1 General

There are no flow meters for either the old or new filter backwash systems.

B.4.2 Old Plant

Filter backwash volumes for the old plant are based on backwash pump run time. The backwash pump has a capacity of 11765 m^3/d (1800 igpm) and is operated for approximately 10 minute backwash. The actual length of time for backwash and estimated backwash volume is recorded daily on a monthly log sheet. The number of backwashes per day is not recorded.

B.4.3 New Plant

There are no flow meters on the new Graver filters to measure backwash flows. The backwash volume can be estimated based on the Graver design backwash

flow rate of 11080 m^3/d (1695 igpm) over a preset 3 minute period. The filter backwash count, and backwash timer setting are recorded daily on a monthly log sheet.

B.5 FILTER FLOW MEASUREMENT

B.5.1 General

There are no flow meters to measure either old or new plant filtered water flows. Filtered water is directed from both plants to an interconnected clearwell.

B.6 TREATED WATER FLOW MEASUREMENT

B.6.1 Old Plant

Water is pumped from the old high lifts through a 300 mm (12") discharge watermain to the distribution system. The old high lift pumps rely on pump run time in order to calculate flows since the Bailey flow meter is out of service. The operators have found that it is too difficult and expensive to obtain parts for the broken Bailey meter on the 300 mm (12") line. The pump run time and daily flow are recorded daily on a monthly log sheet.

B.6.2 New Plant

In the event the old high lift pump cannot maintain a preset level in the elevated tank, it turns off and one of the new larger high lift pumps turn on. There is a Kent Veriflux type VUA3405111320 magnetic flow meter on the 400 mm (16") discharge line submerged within the clearwell. The unit was once thought to be in good working order but the records indicate that this may not be the case. The unit is located underwater and has never been recalibrated. The unit is difficult to calibrate in its present location. The primary element on the unit is a Veriflux detector head with a capacity range of 1282 m^3/d (196 igpm) to 12820 m^3/d (1960 igpm). The flow meter reading and total gallonage pumped is recorded daily on a monthly log sheet. No flow recorder is available with this unit.

B.7 FLOW MEASUREMENT - DOAN'S HOLLOW

Prior to September 1986, flow measurements were based on pump run time. In September 1986, a 100 mm (4 in.) Neptune Trident flow meter was installed.

The meter has a turbine rotor dual suspension primary element with a capacity range of 54.5 m^3/d (8.3 igpm) to 5448 m^3/d (830 igpm). The unit has not been recalibrated since 1986. The time of day, flow meter reading, and actual gallonage pumped is recorded daily on a monthly log sheet.

B.8 VALIDITY OF RECORDS

B.8.1 General

The monthly summary for raw and treated waters in Appendix 3 is a good indicator of seasonal trends in water consumption. It is evident that the Port Dover water consumption follows the general trend of higher consumption during the summer months. From the following table, it is evident that the average day per capita flows are slightly higher than the other municipalities within the area.

In the Town of Port Dover, the average day per capita consumption for 1985 is approximately 658 Lpcd (145 gpcd).

TABLE B-2

WATER PRODUCTION REQUIREMENTS FOR VARIOUS MUNICIPALITIES IN VICINITY

		AVERAGE DAY PER CAPITA PRODUCTION					
Location	Population (1985)	1986		1985		1984	
		LPCD	GPCD	LPCD	GPCD	LPCD	GPCD
Port Dover	4 682	625	137	658	145	686	151
Port Rowan	800	593	131	617	136	680	152
Waterford	2 557	466	105	433	95	418	92
Caledonia	4 609	449	99	508	112	513	113
Simcoe	14 196	506	111	500	110	470	103

This higher per capita production could be attributed to the following factors:

1. The presence of two fish processing plants that generally use large volumes of water. They operate 24 hours/day during certain times of the year, and require as much as 450 m^3/d (100,000 gallons/day).

2. The presence of a large greenhouse which requires large amounts of water for irrigation and boilers.

3. A large influx of tourists to the area during the summer season.

4. Flat rate billing.

The average day per capita flows tend to increase with the presence of high water consuming industries. The increase is more evident in smaller communities such as Port Dover.

A large number of tourists would increase the average day per capita consumption for the area.

B.8.2 Water Plant

It would appear from plant records that raw water flows are 14% to 69% greater than the treated water flows for the water plant. The difference between raw and treated water flows should be approximately 10% based on both the old and new plant running i.e., all filters backwashed once per day and a "blowdown" on both clarifiers once every 90 minutes for two minutes. The difference between raw and treated water increased from 1984 to 1986. The excess raw water flows can be attributed to the following:

1. The rated capacity stated on the old low lift pump name plate and used for flow calculations is 450 gpm. The actual capacity of each pump, according to the file records, is 400 igpm or 450 US gpm. The two capacities are not equivalent. The operators do not know how the capacity was derived or where the information was obtained. There are no operations and maintenance manuals for the two old low lift pumps. From this information, it is presumed that the old plant flow records are in US gpm and hence the recorded flows are 20% greater than the actual flows.

2. At times of lower system demand, operations staff have decreased flow to the clarifier in order to minimize the number of operational stop/starts. The

control of flow to the clarifier is adjusted by manually throttling the valve on the discharge line from the old low lift pumps to the clarifier. The old low lift plant flow is based on pump run time at a set rated flow (450 igpm). Since there is no flow meter on the old low lift header, the adjusted flow rate cannot be accurately estimated. There is also no indication from the plant records as to when these events occurred or when flow rates were adjusted. We would presume that the actual old low lift flows are less than the recorded flows.

3. There is no standard sludge blowdown procedure for the old clarifier nor any means of flow measurement. It has been reported by Operations personnel that an excessive amount of water is used for the sludge blowdown on the old clarifier.

4. It is also possible that the new high lift flow meter may not be recording properly since it has not been calibrated since 1976.

B.8.3 Doan's Hollow

The flows recorded with the flow meter are, on average, 136 to 227 m^3 (30,000 to 50,000 gallons) greater than the flows estimated on pump run time over a 24 hour period. This amounts to a 25% increase in flow.

The rated capacity of the pump is 2290 m^3/d (350 igpm). There are no pump curves available on site for this unit. Recorded flows prior to September 1986 were based on a pump capacity of 45.5 m^3/hr (10000 gph) or 1091 m^3/d (166.7 igpm). The operators do not know how the actual working capacity (45.5 m^3/hr) was derived. The pump capacity has never been rechecked and pump curves are unavailable.

B.9 CONCLUSION

Table B-2 indicates that the average day per capita flows are slightly higher than the other municipalities of similar size within the area. The factors presented in Section B.8.1 explain some of the possibilities for the higher consumption rates. The works listed below should be incorporated into an operation and maintenance program. This will ensure the equipment is recording correctly or operating at the rated capacity. In order to accurately confirm the validity of the records, the following works are necessary:

- Old Plant

1. A flow meter should be installed in the old low lift plant and recalibrated on an annual basis.

2. The capacity of the old low lift pumps should be checked.

3. Clarifier wastewater volumes should be measured in order to compare raw and treated water flow.

4. Tests should be conducted to determine approximate backwash volumes.

5. A flow meter should be installed on the old section of the high lift and recalibrated on an annual basis.

- New Plant

1. The flow meter on the new low lift plant should be recalibrated annually.

2. The capacity of the new low lift pumps should be checked.

3. Wastewater volumes from the clarifier should be measured in order to compare raw and treated water flow.

4. Tests should be conducted to determine approximate backwash volumes.

5. The new high lift flow meter should be relocated to a better location and recalibrated on an annual basis.

6. Upon completion of the above-noted works, it is recommended that a mass flow balance be conducted through the plant. This should be done on an annual basis.

The above improvements could be staged to first upgrade the new plant and, as demand increases, upgrade the old plant, since the new plant is capable of supplying the present maximum day demand.

- Doan's Hollow

1. The capacity of the pump should be re-checked.
2. The flow meter should be re-calibrated on an annual basis.

SECTION C

PROCESS COMPONENTS

SECTION C

PROCESS COMPONENTS

C.1 GENERAL

The following sections describe the general characteristics of the water treatment plant facilities of the Port Dover Water Treatment Plant. Figure No. 2 represents the general layout of the water plant and Figures No. 3 and 4 represent block schematics of the water plant. At present, physical treatment consists of screening, flocculation/sedimentation and filtration while chemical treatment consists of chlorination and turbidity reduction through use of poly-aluminum chloride (SternPAC).

C.2 DESIGN DATA

C.2.1 Capacity

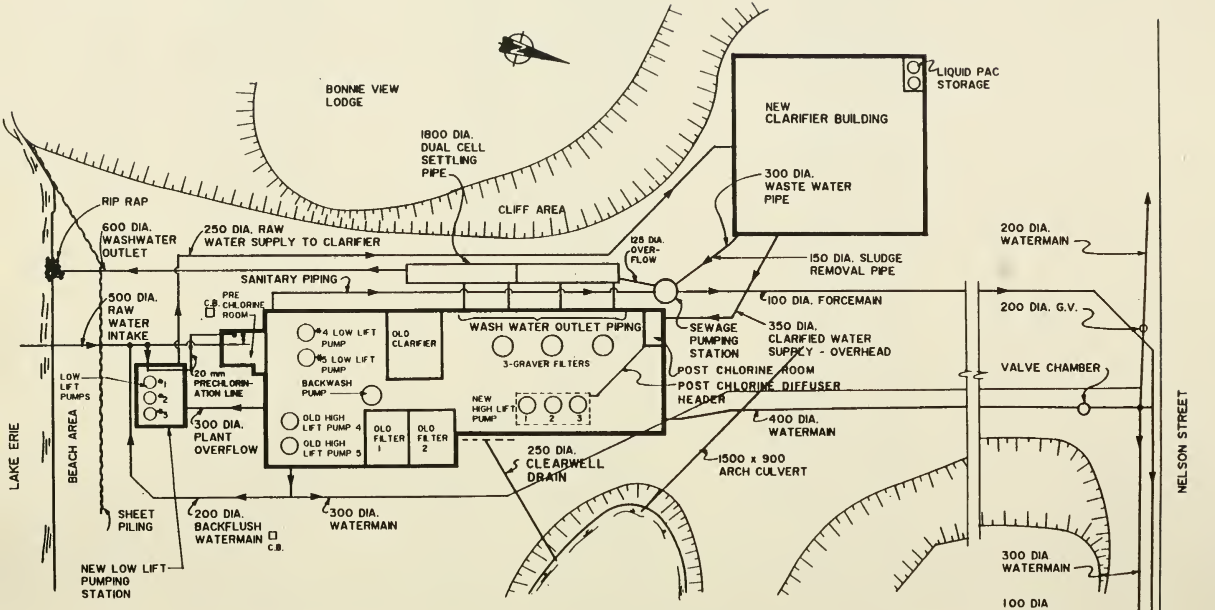
The original water plant was constructed in 1954 with a design capacity of 4.55 ML/d (1.0 migd). The plant was expanded in 1976 to a rated capacity of 10.7 ML/d (2.36 migd). The available information has been reviewed and it is concluded that the plant (old and new) should be capable of producing 9.7 ML/d (2.13 migd) based on the present Ministry of the Environment Guidelines for the Design of Water Treatment Works - April 1982.

The maximum day system consumption recorded in 1986 was 4.91 ML/d (1.08 migd) based on flow records from both the water plant and Doan's Hollow Infiltration Gallery.

C.3 PROCESS COMPONENT INVENTORY

C.3.1 Intake

A 500 mm welded steel intake pipe extends 457 metres (1500 ft.) into Lake Erie. The intake was constructed in 1954 with the original plant. The intake delivers water to both the old and new sections of the plant. The capacity of the intake, based on a 'C' coefficient of 100 is calculated to be approximately 32,570 m^3/d (7.2 migd). The intake has a backflush system. The backflush system has been operated twice since 1983. It was used once in 1983 and once in 1984 to remove frazil ice.



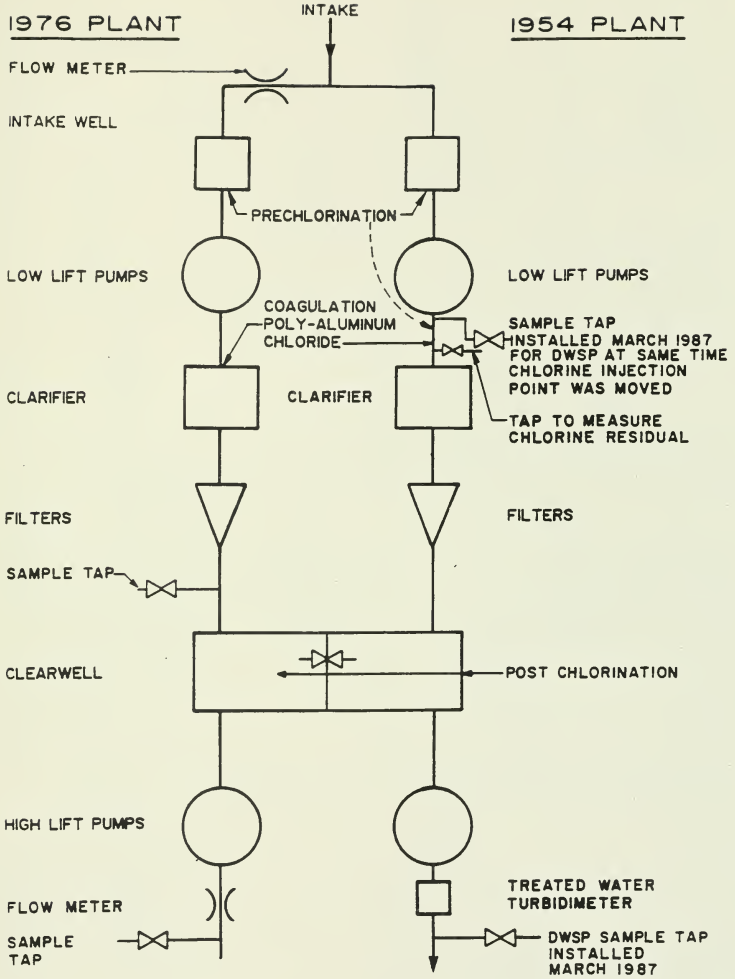
PORT DOVER
WATER PURIFICATION PLANT

SITE PLAN

FEBRUARY 1987 SCALE 1:250

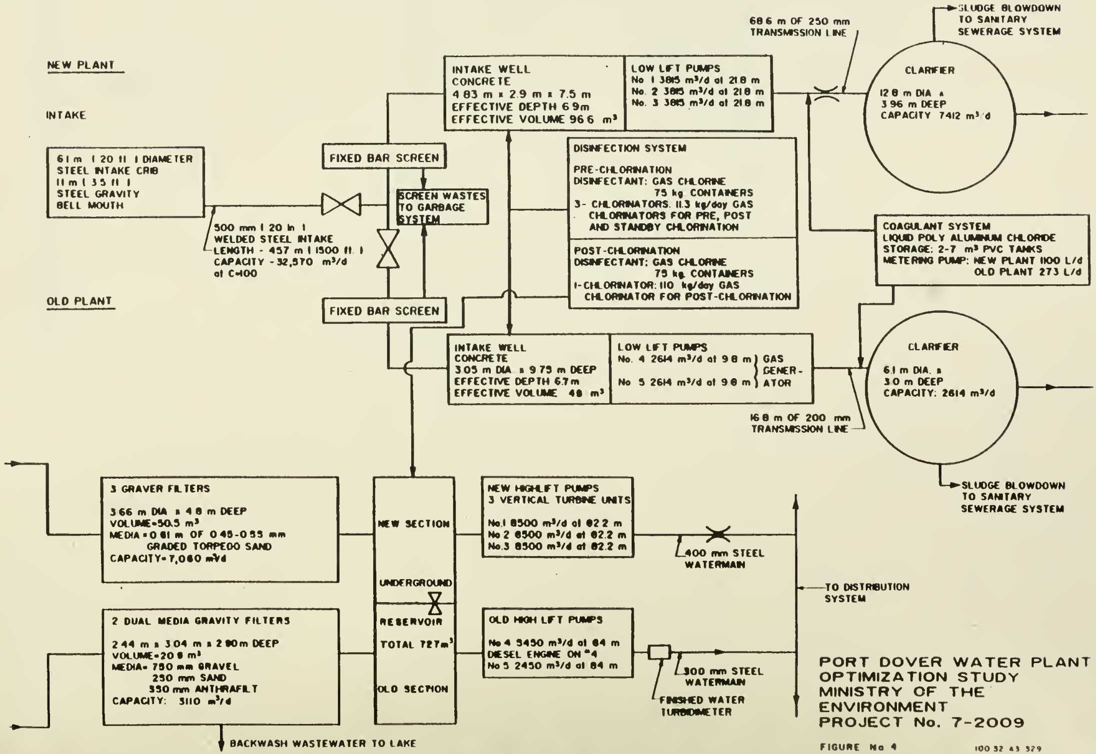
FIGURE NO. 2

100 52-A3 527



PORT DOVER WATER TREATMENT PLANT
- OPTIMIZATION STUDY PROCESS SCHEMATIC

FIGURE NO. 3



PORT DOVER WATER PLANT OPTIMIZATION STUDY
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FIGURE No 4

100 32 43 329

The intake crib is constructed of concrete and is 2.3 m x 2.3 m x 1.8 m in size. The intake crib inlet is 0.9 m in diameter. Since the source level has been regulated, the depth of the intake crib is a minimum 4.3 metres below the low water level of Lake Erie based on historical information.

The intake delivers water to both sections of the water plant. There is a valve on the main intake into the plant and on the intake leading to the old clearwell in order to isolate flow to the new section of the plant. In order to clean out the new clearwell, the entire plant must be shut down. There are no provisions for any chemical addition or water sampling on the intake.

C.3.2 Screening

Old and New Plants

There is a manual bar screen on each of the two pipes leading into the intake well. The steel screens are used to prevent large debris, fish, etc. from entering the purification process.

The screens are manually cleaned once per week before any noticeable accumulations can build up. The screen wastes are mainly small fish and are disposed of through the garbage system. There are no records of the volume of waste cleaned from the screens. The operators estimate the screen waste volumes amount to less than 22 litres (5 gallon bucket) a week.

C.3.3 Intake Wet Wells

C.3.3.1 General

The Port Dover Water Treatment Plant is divided into two parallel treatment processes: the original (old) and the expansion (new) plants. The description of the two intake wells is as follows:

1. Old Plant Intake Wet Well:

Material:	concrete
Dimensions:	3.05 m dia. x 9.75 m deep Effective Water
Depth:	6.7 m
Volume:	49.0 m^3
Chemical Addition:	Chlorine injection point was moved from the old wet well to the discharge of the old low lift pumps in March 1987 as part of the DWSP.

2. New Plant Intake Wet Well:

Material:	concrete
Dimensions:	4.83 m x 2.9 m x 7.5 m
Effective Water Depth:	6.9 m
Effective Volume:	96.6 m^3
Chemical Addition:	Chlorine in the wet well

C.3.4 Low Lift Pumping

C.3.4.1 General

There are five low lift pumps forming part of the screen and wet well unit. The low lift pumps are as follows:

LOW LIFT PUMPS

PUMP NO.	MAKE	TYPE (m^3)	CAPACITY (m)	HEAD	kW	MOTOR
New Plant						
1	Worthington)	Vertical	3815	21.8	14.9	Westinghouse
2	Worthington)	Turbine	3815	21.8	14.9	Westinghouse
3	Worthington)		3815	21.8	14.9	Westinghouse
Old Plant[1]						
4	Smart-Turner)	Horizontal	2614	9.8	5.6	Westinghouse
5	Smart-Turner)	Split Case Side Suction	2614	9.8	5.6	Westinghouse

[1]NOTE: *ONAN Generator Supplies Emergency Power To Low Lift Pumps #4 and #5*

The total installed capacity is 16,673 m^3/d (3.67 migd) and the firm capacity is 12,858 m^3/d (2.83 migd).

The present arrangement of the plant with two complete treatment processes, i.e. old and new plants, provides security for water supply. There is no interconnection between the old and new low lift pump forcemains or stations.

The low lift pumps presently start as a function of the clearwell level. One of the old low lift pumps is initially started. If the demand cannot be met, the old low lift pump stops and two of the three new low lift pumps start. The three low lift pumps in the new plant start in sequence of either Pump 1 and 2, or Pump 2 and 3, or Pump 1 and 3. The run times on the low lift pumps are maintained approximately the same by changing duties.

C.3.5 Transmission

C.3.5.1 Old Plant

Raw water for the original plant is transmitted through a 200 mm (8-inch) diameter steel pipe a distance of 16.8 metres (55 ft.) to the clarifier. The low lift pumps have sufficient total dynamic head to pump water from the wet well to the clarifier.

C.3.5.2 New Plant

Raw water from the new plant is transmitted through a 250 mm (10 inch) steel pipe a distance of 68.6 m (225 ft.) to the new clarifier. The low lift pumps have sufficient total dynamic head to pump raw water to the clarifier.

C.3.6 Clarifier/Flocculator

C.3.6.1 Old Plant

The original treatment process includes a combination flocculation/ sedimentation unit - a proprietary unit known as an Accelator. The unit is constructed of concrete and is 6.1 m (20 ft.) in diameter and 3.0 m (9.8 ft.) deep. There are no design manuals available which indicate the design flow rate of the unit, but plant operators indicate that the unit is capable of handling a flow of 2614 m^3/d. Based on a 2614 m^3/d flow, the up-flow rate, including the central draft tube area, is 3.7 m/h.

C.3.6.2 New Plant

In the new section of the water plant, a proprietary treatment unit-Graver Reactivator combines the flocculation/sedimentation process. The unit is constructed of steel and is 12.8 metres (42 ft.) in diameter and 3.96 metres (13 ft.) deep. The unit has a design flow rate of 7412 m^3/d (1134 igpm) at the design detention period of 90 minutes. The Graver operating manual

recommends 90 minutes as the optimum design detention period. The up-flow rate for the new plant clarifier at a flow rate of 7412 m^3/d is 2.4 m/h.

The unit utilizes the water pressure contained within the unit to flush the sludge accumulation to the sanitary sewage system. This sludge 'blowdown' runs on an automatic timer once every 90 minutes for approximately two minutes at a preset rate of 2.94 m/h (1 igpm /ft^2).

The selection of turbine speed is based on the relationship between the sludge concentration in the draft tube and the concentration of the sludge blanket. The sludge concentrations are based on V/V test. The term V/V is generally used when referring to a sample which is obtained in a 100 mL graduated cylinder and allowed to settle for 10 minutes. The amount of sludge present in the sample is measured as a percentage of the total volume of sample collected. It is recommended to maintain a V/V reading in the draft tube of 3 to 5% below V/V reading in the sludge blanket.

C.3.7 Filters

C.3.7.1 General

Following the removal of a large portion of the suspended materials by the flocculation/sedimentation process, it is necessary to filter the water to reduce the suspended solids concentration and colour. There are five filters in service, as follows:

FILTERS

FILTER NUMBER	DIMENSIONS	CAPACITY (m^3/d)	EFFECTIVE AREA (m^2)	EFFECTIVE VOLUME (m^3)
Old Plant				
1	2.4 m x 3.0 m x 2.90 m deep	1555	7.2	20.9
2	2.4 m x 3.0 m x 2.90 m deep	1555	7.2	20.9
New Plant				
3	3.66 m dia. x 4.8 m deep	2353	10.5	50.5
4	3.66 m dia. x 4.8 m deep	2353	10.5	50.5
5	3.66 m dia. x 4.8 m deep	2353	10.5	50.5

C.3.7.2 Old Plant

Filters No. 1 and 2 are located in the original section of the plant. They are dual media gravity filters originally consisting of 350 mm of anthrafilt, 250 mm of sand and a 750 mm of gravel. The depth of media was measured in December 1986 by Operations staff. Operations personnel indicate that uniformity coefficient and effective size data are not available. Operations personnel have also indicated that the filter media has not been replaced since the plant was opened in 1954. There are no design manuals available for the old filters. If we consider the old plant independent of the new plant, the maximum filtration rate permitted by the Ministry of the Environment Guidelines for a facility with two filters is 9 m/h. We would estimate the maximum filter rate of each old filter as 1555 m^3/d for a total capacity of 3110 m^3/d.

Although it could be argued that a higher rate could be used for the filters, it is not necessary based on the capacity of the existing accelerator.

C.3.7.3 New Plant

The three new filters are proprietary Graver units, constructed of steel. The units have a rated capacity of 2353 m^3/d (360 igpm) ([9.4 m/h] 3.18 igpm/ft^2) for a total capacity of 7059 m^3/d. The filtering rate for the new filters is 9.4 m/h which is within the maximum allowable filtration rate of 12 m/h as recommended in the Ministry of the Environment Guidelines for the Design of Water Treatment Works - April 1982.

C.3.8 Filter Backwash

C.3.8.1 Old Plant

The filters are backwashed once per day for approximately 10 minutes, utilizing a Smart Turner pump rated at 11,765 m^3/d (1800 igpm) at 6.1 m (20 ft.) TDH. The backwash pump is a horizontal split case pump with a 14.9 kW General Electric motor. The source of backwash water is the old treated water clearwell. The filters are backwashed at a rate of 68 m/h based on the pump rating. This rate far exceeds the Ministry's recommended value of 45 m/h which has resulted in a loss of anthrafilt. The backwash pump has never been re-checked for capacity. There is no means of controlling the backwash flow rate other than by the manual discharge gate valve. In the normal operation or control of a backwash system, the wash water flow rate is gradually increased at the start of the wash to prevent upsets of the bed and gradually

decreased at the end of the wash to allow the bed to stratify properly. There are no surface wash sweeps on the existing filters.

There are no provisions available on these filters for measuring headloss or influent/effluent water turbidity levels. It is an operator's decision to backwash more than once a day.

The volume of water filtered per cycle and the backwash water volume per wash cannot be calculated, since the number of backwashes per day is not recorded.

The filter backwash wastes are discharged to Lake Erie, through a CSP detention clarifier described in Section C.3.11.

C.3.8.2 New Plant

The Graver units can be automatically backwashed, at a pre-set headloss. The filters are backwashed, utilizing the water contained within the unit through a gravity process at a design rate of 11 080 m^3/d (1695 igpm) or an up-flow rate of 44 m/h (15 $igpm/ft^2$), which is within the rate considered adequate under the Ministry of Environment Guidelines for the Design of Water Treatment Works - April 1982.

The filter backwash wastes are discharged to Lake Erie, through a CSP detention clarifier described in Section C.3.11.

C.3.9 Clearwell

C.3.9.1 General

The filter effluent is directed to the two interconnected clearwells directly below the filters. The two clearwells are connected by a 400 mm pipe and valve. The combined effective capacity of the clearwell is 727 m^3. The clearwell is the source of water for backwashing the old filters. A 300 mm steel overflow is connected into the new raw water wet well from the old section of the clearwell.

The description of the two sections of the clearwell are as follows:

1. Old Plant Clearwell

Material:	Concrete
Dimensions:	Square: 12.8 m x 12.8 m x 3.0 m deep
Effective Depth:	2.24 m
Volume:	367 m^3
Baffles:	None

2. New Plant Clearwell

Material:	Concrete
Dimensions:	Rectangular: 15.8 m x 10.2 m x 3.0 m deep
Effective Depth:	2.24 m
Volume:	360 m^3
Baffles:	None

C.3.10 High Lift Pumps

The high lifts draw treated water from the clearwell storage and pumps to the distribution system. There are five high lift pumps with the following descriptions:

HIGH LIFT PUMPS

PUMP NO.	MAKE	TYPE	CAPACITY (m^3/d)	HEAD kW (m)		MOTOR
New Plant						
1	Worthington	Vertical Turbine	8,500	82	112	Westinghouse
2	Worthington	Vertical Turbine	8,500	82	112	Westinghouse
3	Worthington	Vertical Turbine	8,500	82	112	Westinghouse
Old Plant[1]						
4	Delaval	Horizontal Centrifugal	5,450	84	74.6	General Electric
5	Delaval	Horizontal Centrifugal	2,450	84	44.8	General Electric

[1]NOTE: *Diesel generator available for High Lift Pump No. 4.*

The high lift station capacity is:

1. Total Capacity: 33,400 m^3/d (7.3 migd)
2. Firm Capacity: 24,900 m^3/d (5.5 migd)

At present the total standby capacity is 5,450 m^3/d (1.2 migd). Based on this rate, there is sufficient standby capacity to meet the maximum day consumption for 1986 which was 4910 m^3/d (1.08 migd). The maximum day consumption over the study period was 5,930 m^3/d (1.3 migd) in 1984.

There is no surge protection on either the old or new high lifts pumps.

C.3.11 Backwash Treatment

The filter backwash waters from both the old and new filters are discharged to an 1800 mm (6 ft.) diameter corrugated metal pipe settling tank (CSP detention clarifier). The pipe is 18.3 m long with an effective volume of 30 m^3. The backwash waters are drained untreated to Lake Erie.

C.3.12 Sludge Disposal

Water plant sludge from the clarifiers is flushed to a pumping station adjacent to the water plant and is pumped to the sewage system.

The sewage pumping station is 1.83 m (6 ft.) in diameter and has an effective volume of 4.1 m^3 (145 $ft.^3$). The pumping station contains two Flygt electric sewage pumps Model No. CP3101-432 (one as standby). There are no certified pump curves or shop drawings for these units on site. The capacity of each pump has been calculated to be approximately 1000 m^3/d (153 igpm) at 12.5 m (41 ft.) TDH. The water plant sludge is pumped untreated through a 100 mm (4") forcemain to a manhole and gravity sewer on the corner of Mergl Drive and Nelson Street West.

C.3.13 Chemical Systems

The chemical facilities include the storage and dispensing of chlorine gas and liquid poly-aluminum chloride (SternPAC). The chemical facilities are located throughout the treatment plant as shown on Figure No. 2 - Site Plan.

C.3.14 Poly-aluminum Chloride (PAC or SternPAC)

C.3.14.1 General

Poly-aluminum chloride is used for the coagulation of suspended solids to the appropriate size for "sedimentation"/filtration. Polyaluminum chloride is supplied by Sternson under the brand name SternPAC. The Port Dover Water Plant was

the first water plant in North America to utilize liquid PAC for turbidity reduction. Prior to 1985, powdered PAC was used for the coagulation of suspended solids. The use of powdered PAC was discontinued due to the cost of the material and the inconvenience of handling and mixing the PAC solutions.

The appropriate PAC dosage is dependant on raw water turbidity, temperature, alkalinity, pH and other raw water quality parameters. Only empirical relationships exist for determining the appropriate PAC dose, and therefore regular jar testing is required to find the appropriate PAC dose for the prevailing conditions. Daily records of jar testing are not maintained but daily PAC consumption records are maintained in the logs.

There are 2-7 m^3 (1550 gallons) PVC tanks which store sufficient quantities of chemicals for the plant requirements. The tanks are in the new clarifier building.

C.3.14.2 Old Plant

The PAC is manually hauled from the storage tanks to the 159 litre (35 gallon) PVC day tank as required. The day tank and solution metering pump is located in the original building adjacent to the old low lift pumps. The PAC solution is fed into the discharge line of the old low lift pumps by a Liquid Metronics solution metering pump rated at 273 L/d (60 gpd). The feed rate is manually adjusted depending on the raw water turbidity and results of the jar test when performed. The feed rate and gallons of PAC solution used per day is recorded daily on a monthly log sheet. A chart of metering pump setting versus dosage has been developed for the convenience of operators.

C.3.14.3 New Plant

The PAC solution is gravity fed to the PVC day tank. The day tank and solution metering pump is located in the new clarifier building adjacent to the storage tanks. The PAC solution for the new plant is injected by a Liquid Metronics solution metering pump rated at 1100 L/d (240 gpd) at the inlet pipe upstream of the 90° bend by the clarifier. Again, a chart of metering pump setting versus dosage has been developed for operator convenience. The feed rate is manually adjusted depending on the raw water turbidity and results of the jar test when performed. The feed rate and pounds of PAC solution used per day is recorded daily on a monthly log sheet.

C.3.15 Pre-Chlorination

C.3.15.1 General

The pre-chlorination facilities are located within the original wooden wet well building. The facility is not properly ventilated and could prove to be a potential hazard should a chlorine leak occur. There are three Capital Control Company chlorinators. There is a chlorinator for each of the old and new plants and one for standby, each with a capacity of 11.3 kg/d (25 lb/d). Chlorine gas is supplied to the plant in 75 kg cylinders.

C.3.15.2 Old Plant Pre-Chlorination

The pre-chlorine was applied in the old wet well until the initiation of the DWSP at the plant in March 1987. The pre-chlorine application point was then changed to the discharge side of the old low lift pumps. A stainless steel raw water sample tap was installed on the discharge side of the old low lift pumps before any chemical application. The pre-chlorinator can supply 4.3 mg/L chlorine at a flow of 2614 m^3/d (firm capacity of old plant).

The pre-chlorine residual is measured three times per day using a DPD reagent and a HACH DR100 Colorimeter. Depending on the measured residual, pre-chlorine dose is manually adjusted. The chlorine feed rate, the daily chlorine consumption weighed in pounds, and the chlorine residual are recorded daily on a monthly log. The chlorine demand is not recorded or calculated by the operators.

C.3.15.3 New Plant Pre-Chlorination

The pre-chlorine application point is in the wet well of the new plant pumping station. The pre-chlorinator can supply 1.48 mg/L chlorine at a flow of 7630 m^3/d which is the firm capacity of the new plant. The pre-chlorine residual in the new plant is measured three times per day with a DPD reagent and a HACH DR100 Colorimeter. Depending on the measured residual, pre-chlorine dose is manually adjusted. The chlorine feed rate, the daily chlorine consumption weighed in pounds and the chlorine residual are recorded daily on a monthly log. The chlorine demand is not recorded or calculated by the operators.

C.3.15.4 Post-Chlorination Old and New Plant

The post-chlorine facility is contained within a fully enclosed concrete room at the front of the original building. The post-chlorinator is a Wallace & Tiernan V-notch, 200 lb., Series V800 Chlorinator. Chlorine Solution is applied in the new section of the treated water clearwell chlorinating both the new and old sections. The post-chlorinator can supply 10.7 mg/L at a flow rate of 8500 m^3/d (capacity of one new high lift pump).

Depending on the measured residual, the post-chlorine dose is manually adjusted. There is a chlorine residual analyzer on site but is not in working order. The post-chlorine residual is measured three times per day with a DPD reagent and a HACH Model DR100 colorimeter. The chlorine feed rate, daily chlorine consumption weighed in pounds, and the chlorine residual are recorded daily on a monthly log.

The summary of the disinfection profiles is included as part of Appendix 3.

C.3.16 Standby Power

There are two standby power units on site.

UNIT	MAKE	MODEL	POWER (kW)	TYPE	SIZE OF TANK (L)	COMPONENTS
Old Plant						
1	ONAN	35ED-gR8/1G	35	GAS	114	- low lift pump No.4 or No.5 - old clarifier sludge re-circulator - SternPAC chemical feed pump - plant pre-chlorinator - lighting
2	CATERPILLAR	D318	68	DIESEL	1135	- high lift pump No. 4

New Plant

No standby facilities available.

C.3.17 Doan's Hollow Infiltration Gallery

Figure No. 5 shows the general layout of Doan's Hollow Infiltration Gallery. Doan's Hollow Infiltration Gallery collects water through a series of tile beds upstream of the pond. The exact location and extent of the tile beds is unknown. The infiltrated water is fed by gravity through a 150 mm (6") cast iron pipe to the dam and pumphouse. There is a bypass connection between the dam and the 150 mm (6") cast iron pipe. There is also a shear gate between the pumphouse reservoir and pond.

The raw water is chlorinated with sodium hypochlorite by a chemical feed pump. The chemical feed pump is a Liquid Metronics feed pump Model A121-91T rated a capacity of 109 L/d (24 gpd). The chlorine dosage is manually adjusted depending on the measured residual. The chlorine residual is measured three times per day during the week and twice a day during the weekend. The chlorine residual is measured with a DPD reagent and a HACH DR100 colorimeter. The chlorine feed rate, daily chlorine consumption weighed in pounds, and the chlorine residual are recorded daily on a monthly log. The chlorine demand is not recorded or calculated by operations staff.

The treated water is pumped to the distribution system by a Babcock Centrifugal pump rated at 2290 m^3/d (350 igpm) at a TDH of 45.7 m (150 ft.). The pump has an 18.7 kW (25 HP) General Electric Motor.

DOAN'S HOLLOW INFILTRATION GALLERY

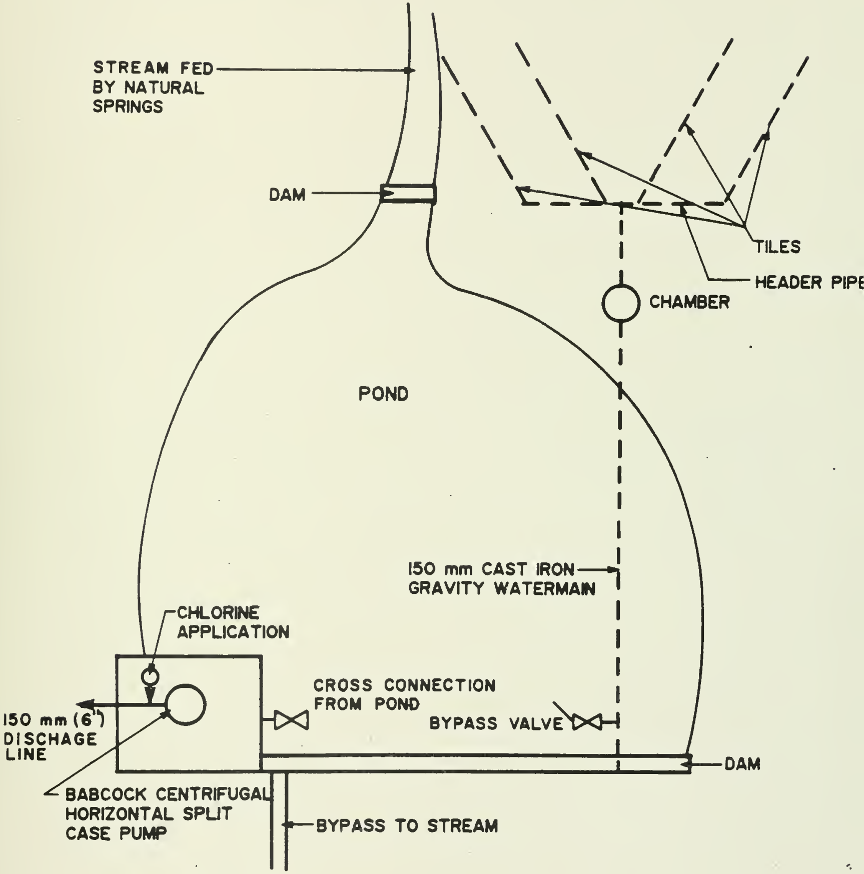

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FIGURE No. 5

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SECTION D

PLANT OPERATION

SECTION D

PLANT OPERATION

D.1 GENERAL DESCRIPTION

The following section describes the general operation of the Port Dover Water Treatment Plant as well as Doan's Hollow Infiltration Gallery with respect to sampling, monitoring, recording, chemical dosage control, filter backwash procedure and flow control. Operational and process weaknesses which may adversely affect water quality are also described.

D.2 WATER PLANT OPERATION

D.2.1 General

The water plant is operated on a stop/start (on/off) mode of operation. According to daily flow records, the raw water requirements at the water plant for 1986 ranged between 2.09 ML/d and 7.93 ML/d.

D.2.1.1 Old Plant

The old plant was custom built in 1954 with a capacity of 4.55 ML/d (1.0 migd). The capacity of the process components are summarizedas follows:

PROCESS COMPONENT	INSTALLED CAPACITY (m^3/d)
INTAKE: Common to both old and new plants = 32570 m^3/d at C=100	
LOW LIFT PUMPS	2 pumps at 2614 = 5228
CLARIFIER	1 clarifier at 2614 = 2614
FILTER	2 filters at 1555 = 3110
HIGH LIFT PUMPS	1 pump at 5450 & 1 pump at 2450 = 7900
RESERVOIR	367 m^3

D.2.1.2 New Plant

The new plant was built in 1976 with a rated capacity of 6.15 ML/d (1.36 migd). The expansion increased the rated capacity of the plant to 10.7 ML/d (2.36 migd). The clarifier and filters are package components manufactured by Graver. The process capacity of the components are summarized as follows:

PROCESS COMPONENT	INSTALLED CAPACITY (m^3/d)
INTAKE: Common to both old and new plants = 32 570 m^3/d at C=100	
LOW LIFT PUMPS	3 pumps at 3815 = 11 445
CLARIFIER	1 clarifier at 7412
FILTER	3 filters at 2353 = 7059
HIGH LIFT PUMPS	3 pumps at 8500 = 25 500
RESERVOIR	360 m^3

The water plant is operated by a stop/start (on/off) mode of operation. The intake is common to both sections of the plant. The old plant can be operated independent of the new plant. A detailed description of the operation is included in this section.

D.2.1.3 Operation Staffing

The water plant is manned five days a week, eight hours a day by Region of Haldimand-Norfolk Operations personnel. There is: one supervisor; one foreman; one sub-foreman; and 3 system operators. The supervisor and one system operator maintain the water plant. The other staff are responsible for the operation and maintenance of the distribution system. The operators rotate on a weekly basis. The water plant is checked twice daily during the weekends by the on-call operator.

D.2.2 Raw Water Supply

Raw water is drawn by gravity from Lake Erie through a 500 mm (20-inch) intake rated with a capacity of 32,570 m^3/d (7.2 migd) using a C-coefficent of 100. The raw water is directed to the old and new intake wet wells. The manual bar screens are cleaned once per week using a garden hose. The screen wastes are disposed of through the garbage system. There are no

records for solid waste volumes from the screens. The operators estimate the volume of waste from the screens amount to less than 22 litres (5 gallon bucket) per week and at this rate there does not appear to be a need for a rotating (automatic or manual) bar screen. The present procedures for operating and cleaning the bar screens are acceptable.

There is an isolating valve on the intake leading to the old wet well but no isolating valve on the section of intake leading to the new wet well. If any work were required in the new wet well, the main 500 mm intake valve would have to be closed, resulting in a complete shutdown of the water plant treatment processes.

D.2.3 Sampling Systems

The Ministry of the Environment obtained raw and treated water samples approximately four times per year during the study period 1983 - 1985. The data are contained in Appendix 3.

The Port Dover operations personnel conduct regular in-plant testing. Table D-1 summarizes the tests.

Table D-2 summarizes the water sampling system at the Port Dover Water Treatment Plant.

Raw water samples must be taken before any physical or chemical treatment. Prior to the change in pre-chlorine application point from the old wet well to the discharge of the low lift pumps and the installation of the DWSP sample taps, the Ministry of the Environment obtained lake grab samples for water quality testing. This procedure more often than not resulted in samples that were not representative to the water entering the wet well via the intake. The chlorine application point for the new plant should also be changed from the wet well to the discharge side of the low lift pumps as stated on the recommendations in Section G. This would permit raw water sampling from the wet well or the installation of a sampling tap prior to pre-chlorine application. The location and operation of the other sampling systems are acceptable for the respective tests:

1) Old low lift discharge header tap for pre-chlorine residual test when old plant is in operation;

2) Old low lift discharge header tap for raw water turbidity, Ministry of Health bacti tests and DWSP parameter testing when old plant is in operation;

TABLE D-1

PORT DOVER WATER TREATMENT PLANT

IN-PLANT TESTING

TEST	SAMPLING POINT	TESTING AND FREQUENCY	REPORTING	TESTING EQUIPMENT	FREQUENCY OF CALIBRATION	COMMENTS
PRE-CHLORINE RESIDUAL	Tap on discharge old low lift header and tap on new low lift header	3 times/day	once/day	DPD Reagent and HACH DR100 Colormeter	Never Calibrated (not required)	Tap installed in March 1987, as part of DWSP.
POST-CHLORINE RESIDUAL	Tap on old high lift discharge header or tap on new high lift discharge header	3 times/day	once/day	DPD Reagent and HACH DR100 Colormeter	Never Calibrated (not required)	Post-chlorine residual analyzer presently out of order
RAW WATER TURBIDITY	Tap on discharge of old low lift header	3 times/day	once/day	Portable Turbidimeter	Never Calibrated	Presently there is no raw water turbidimeter
TREATED WATER TURBIDITY	Old high lift discharge	3 times/day	once/day	Lisle Metrix Model DRT-200	Once per week Calibrated with portable hand turbidimeter	Installed January 1987 Unit moved from raw water
COLOUR	Grab sample out of lake	3 times/day	once/day	Visual inspection	---	
TEMPERATURE	New wet well	once/day	once/day	Thermometer	---	The unit is maintained by the Ministry of Natural Resources

TABLE D-2

PORT DOVER WATER TREATMENT PLANT
WATER SAMPLING SYSTEM

SOURCE	PUMP/TAP	LINE MATERIAL AND SIZE	TESTS
1. Lake	-	-	Prior to March, 1987 Ministry of the Environment Water Quality Tests
2. Old Low Lift Discharge Header	Tap	13 mm Stainless Steel	DWSP Water Quality Test, Ministry of Health bacti tes Raw water turbidity
3. New Low Lift Discharge Header	Tap	13 mm copper	Pre-chlorine residual,
4. Old Low Lift Discharge Header	Tap	13 mm copper	Pre-chlorine residual,
5. Old High Lift Discharge Header	Tap	18 mm Stainless steel	) Post chlorine residual,) Treated water turbidity,) Ministry of the) Environment Water Quality) Tests, Miniatry of Health) Bacti Tests) DWSP Water Quality tests
6. New High Lift Discharge Header	Tap	13 mm copper	] Post chlorine residual,

3) Old high lift discharge header tap for post-chlorine residual testing when old plant is in operation;

4) Old high lift discharge header tap for treated water turbidity, Ministry of Health bacti tests and DWSP parameter testing when old plant is in operation;

5) New low lift discharge header tap for pre-chlorine residual when new plant is in operation;

6) New high lift discharge header tap for post chlorine residual when new plant is in operation.

The old plant is used as a base supply and therefore DWSP sampling taps were installed only on this section. This sampling from only one section will ensure continuity in samples. There are also sample taps on the new section of the plant but they should not be used for DWSP, since the water samples from the new low lift discharge header tap are already chlorinated and the tap material - copper, is considered inappropriate in water quality testing. The new high lift discharge tap is also made of copper.

The Ministry of Natural Resources have a thermometer in the new wet well in order to monitor water temperatures. Readings are taken on a daily basis and recorded on the monthly log sheet.

Port Dover Water Treatment Plant and Doan's Hollow Infiltration Gallery were added to the DWSP in 1987. The Ontario Ministry of the Environment established the program to form and continuously update a data base of information on raw and treated water quality. The information will be used in connection with this Water Plant Optimization Study to determine an optimum treatment strategy for disinfection and contaminant removal.

D.2.4 Pre-chlorination

There are three gas chlorinators each with a capacity of 11.3 kg/d (25 lb/d). Based on one old low lift pump in operation, the old plant chlorinator can apply chlorine at a rate of 4.3 mg/L. Based on two new low lift pumps in operation,the new plant chlorinator can apply chlorine at a rate of 1.48 mg/L. The third chlorinator is a standby unit. Water samples are obtained three times per day by operators in order to measure the pre-chlorine residual. The pre-chlorine residual is measured with a DPD reagent and a HACH DR 100

colorimeter unit three times a day during the week and twice a day on weekends. Pre-chlorine dose is adjusted based on the residual measured. The pre-chlorinator requires manual adjustment to compensate for immediate changes in raw water quality.

It has been reported that the chlorine application in the new wet well has corroded the bar screen, piping and pump screens. This corrosion could be prevented by changing the pre-chlorine application point from the new wet well to the discharge of the new low lift pumps as discussed in Section G.

D.2.5 Old and New Low Lift Pumps

Raw water is pumped independently to each of the two clarifiers. Either old low lift pump No. 4 or No. 5 operates as a duty pump in the old plant. The duty pump is alternated daily to maintain approximately equal run times. The pump automatically starts as a function of clearwell level. If the pump cannot maintain the level in the clearwell, the old low lift pump stops and two of the three new low lift pumps automatically start. The new low lift pumps are alternated daily in order to maintain approximately equal run times.

D.2.6 Particulate Removal

Liquid poly-aluminum chloride (PAC) is added to the raw water for particulate removal. Liquid PAC is injected in the discharge side of the old lift pumps by a Liquid Metronics solution metering pump Model B-721-915-C rated at 273 L/d (60 gpd). In the new plant, the liquid PAC is injected at the clarifier inlet pipe upstream of the 90° bend in the clarifier by a Liquid Metronics solution metering pump Model D-731-20 rated at 1.1 m^3/d (240 gpd). The metering pumps are calibrated once every six (6) months in accordance with the operations and maintenance manuals. The metering pumps are relatively new and have been kept in good working order and appear to be functioning properly. It is accepted practise to maintain a standby unit of sufficient capacity. The standby unit is not required at the plant since PAC application can be maintained with either pump.

Jar testing is only occasionally conducted. Operations personnel have indicated that jar testing does not always give a good indication of optimum PAC dosage for particulate removal. Operators feel that selection of coagulant dose based on experience is more appropriate than the optimum dosage based on jar tests. The application rate of the solution pumps are manually adjusted. Jar

testing results are not recorded. The metering pumps require manual adjustment to compensate for immediate changes in raw water quality.

The Region has experimented with a Streaming Current Monitor with success. They report to have been able to optimize the PAC dosage rate. The unit would prove beneficial in optimizing plant performance.

There is no raw water turbidimeter. The original raw water turbidimeter was placed on the old treated water discharge line to comply with the Ministry of Environment Guidelines to continuously monitor treated water turbidity. The Lisle Metrix Model DRT-200 turbidimeter is calibrated once per week with the sample cells from the portable turbidimeter.

Poly-aluminum chloride (SternPac) is stored in the new clarifier building near the top of the hill and must be manually hauled to the old plant on a daily basis. The metering pumps and day storage tanks for both the old and new plants are located adjacent to the application points.

D.2.7 Clarifiers

The sludge blowdown from the two clarifiers is discharged to a sewage pumping station adjacent to the water plant through a 100 mm (4") forcemain to the sanitary sewage system. The quantity and composition of the wastewater are not accurately known. The volume of wastewater from the clarifiers has been estimated to be 274 m^3, as detailed in Appendix 1 of this report.

- New Plant

The rated capacity of the new clarifier is 7412 m^3/d (1134 igpm). The up-flow rate, based on two new low lift pumps in operation, 7630 m^3/d (1167 igpm), is 2.5 m/hr. The new clarifier is backflushed on a 90 minute time cycle for two minutes at a preset rate of 2.94 m/h (1 igpm/ft^2).

The sludge blanket reactor clarifiers are not readily adaptable to changes in flow rate and raw water quality. A slow opening raw water inlet valve will be required if the plant is automated. The valve will be required to regulate rapid changes in flow that may upset sludge concentrations. In the present stop/start mode of plant operation, it is important to maintain sludge recirculation in the clarifier. The selection of turbine speed is based on the relationship between the sludge concentration in the draft tube and the

concentration of the sludge blanket. The sludge concentration relationship is based on the V/V test. The test is described as follows:

> *"A sample is obtained in a 100 mL graduated cylinder and allowed to settle for 10 minutes. The amount of sludge present in the sample is measured as a percentage of the total volume of sample collected. It is recommended to maintain a V/V reading in the draft tube of 3 to 5% below the V/V reading in the sludge blanket".*

- Old Plant

The upflow rate of the clarifier including the central draft tube area, based on one low lift pump in operation (2614 m^3/d), is 3.7 m/hr. The generally accepted upflow rate for clarifiers including the central draft tube for Great Lakes water is 6.0 m/h. There is no established backflush procedure for the clarifier. Therefore, volume of sludge withdrawn from the clarifier can be highly variable.

There are no sample taps to withdraw sludge samples and, therefore, the V/V test cannot be performed. The sludge recirculation speed is adjusted depending on the V/V test of the new clarifier.

Without turbidity measurements, it is difficult to evaluate the performance of the clarifiers. Plant staff have indicated that they are working adequately.

D.2.8 Filters

- Old Plant

The old plant clarifier effluent is directed to dual media gravity filters. Only one old filter is operated at a time. Using the recommended Ministry of the Environment filtration rate of 9.0 m/h, the rated capacity of the filters are as follows:

One filter in operation	: 1555 m^3/d
Two filters in operation	: 3110 m^3/d

There are no rate of flow controllers on the filters, thus they filter at the same rate as water is introduced to them. A syphon with an air break was initially installed on the old filters to maintain level. The systems are no longer operational and the level in the filter is extremely low. These syphon/air break arrangements should be placed back into service if possible. If the system

is difficult to repair, a different form of rate control should be installed on the old filters.

The filters discharge directly into the old section of the clearwell. The old filters are not interconnected either to each other or the new filters.

There are some concerns regarding the efficiency of the filters since there have been reported cases of mudballs in the filter media. The filter media has not been replaced since 1954. No characteristic tests (uniformity coefficient, effective size) have been conducted on the filter media. The uniformity coefficient and effective size of the filter media would indicate whether the media should be replaced. At times during backwashing the filters are manually scraped with a rake to loosen mudballs. There are no surface wash mechanisms in place.

The filters are backwashed in the morning for approximately 10 minutes. The backwash pump is manually turned on and off. There is no equipment to measure headloss nor sample taps to obtain a filtered water sample to measure turbidity.

- New Plant

The new plant clarifier effluent is directed to a flow splitting box where the flow is distributed to the Graver filters. There are three Graver filters, each with a rated capacity of 2353 m^3/d (360 igpm) at a filtration rate of 9.4 m/h. There are no rate controllers on the filters. The filters are backwashed once per day. The new plant operates two of the three units at one time. The filters are sequenced to maintain approximate equal run times. The filters can be backwashed based on headloss. Due to the low raw water turbidity, the filters are backwashed once per day. The new filters appear to be working adequately but without actual data it is difficult to evaluate the performance of the filters. A portable hand turbidimeter is available to measure filtered water turbidity but the treated water turbidity is not measured.

D.2.9 Post-Chlorination

The filtrate for the old and new plants is directed to a common clearwell where it is disinfected with a chlorine gas solution. The clearwell is divided into 2 sections, (old and new), interconnected by a 400 mm pipe and valves. Post-chlorine is diffused through a 21 m plastic header surrounding the new

high lift pump intake. The start of the low lift pump(s) initiates the post-chlorinator.

Chlorine is applied in the clearwell through a Wallace & Tiernan V-notch 200 lb, Series V800 Chlorinator. The Chlorinator has a capacity of 10.7 mg/L at a flow of 8500 m^3/d (i.e. capacity of one new high lift pump) The post-chlorine residual is measured three times during the weekdays and twice a day on the weekend with a DPD reagent and a HACH DR100 colorimeter. The post-chlorination system cannot compensate for immediate changes in water quality. Depending on the measured residual, the post-chlorine dose is manually adjusted. The chlorine gas solution is applied based on low lift pump operation. The chlorinator is calibrated on a weekly basis.

There is no standby unit on site. In the event the post-chlorinator breaks down, one of the pre-chlorinators would be used as a post-chlorinator.

The post-chlorine residual analyzer is not functioning properly. The operators report the low temperatures within the building during winter months have damaged the post-chlorinator.

D.2.10 Clearwell

The filter effluent from the old filters is directed to the old section of the clearwell and the filter effluent from the new filters is directed to the new section of the clearwell. The two sections of the clearwell are interconnected by a 400 mm (16") pipe and valve. The total capacity of both sections of the clearwell is 727 m^3 (160,000 gallons).

There is a high and low level alarm in the clearwell. The low lift pumps start as a function of the low level in the clearwell.

Chlorine is applied in the new section of the clearwell through a plastic diffuser surrounding the new high lift pump intake well.

A record of reservoir cleanings has not been maintained. The last time the reservoir was cleaned is not known.

Table D-3 summarizes the effect of pumping rates on retention time.

In the operation of a water treatment facility, approximately 10% of the daily plant output volume is required as clearwell storage for backwashing. The Port

TABLE D-3

PORT DOVER WATER TREATMENT PLANT

CLEARWELL CAPACITY VERSUS TIME TO EMPTY CLEARWELL

Plant Flow m^3/d	Clearwell Volume (m^3)	(mig)	Time to Empty Clearwell (hrs.)	Comments
2450	727	0.16	7.1	Capacity of one old high lift pump
2614	727	0.16	6.7	Capacity of one old low lift pump
3815	727	0.16	4.6	Capacity of one new low lift pump
7630	727	0.16	2.3	Capacity of two new low lift pumps
8500	727	0.16	2.1	Capacity of one new high lift pump
10,000	727	0.16	1.7	Approximate capacity of plant

Dover water plant would require 970 m^3 of storage volume based on the plant capacity of 9700 m^3/d. The volume of storage can be reduced proportionally by 70%, to 291 m^3/d, since the new filters do not use treated water from the clearwell to backwash. Therefore, the water plant has sufficient on site storage.

D.2.11 High Lift Pumping

- General - Old and New Plant

There are five high lift pumps at the Port Dover Water Plant; two old high lift pumps and three new high lift pumps. Normally, old high lift pump No. 5 is the duty pump and is started automatically as a function of water level in the elevated tank. If this pump cannot maintain the level, it automatically shuts off and one of the new high lift pumps is started. The plant is operated in this manner since pump No. 5 can normally meet system demands and it is more economical to run a pump with smaller energy requirements.

- Old Plant

There is no flow meter on the old high lift discharge. Treated water flows are calculated, based on pump run time. There is a Lisle Metrix Model DRT-200 treated water turbidimeter on the old high lift discharge which is reported by Operations staff to be in good working order.

- New Plant

There is a Kent Veriflux flow meter, as described in Section B, on the new high lift discharge line. The meter was installed in 1976 and has not been recalibrated. Its present location, under water, has made it very difficult to calibrate. These units normally do not perform well under water and the flow meter records appear to be erroneous. There is notreated water turbidimeter on the new high lift discharge line.

D.2.12 Stand-by Power

- General

In the event of an isolated power failure at the plant, water is supplied from Doan's Hollow Infiltration Gallery.

- Old Plant

There is a 35 kW Onan Gasoline Powered Generator, Model 35ED-gR8/1G and a 114 L (25 gallon) storage tank located in the original low lift area. The gasoline powered generator can supply sufficient power to operate either low lift pump No. 4 or No. 5, the sludge recirculator on the old clarifier, the SternPac chemical feed pump for the old plant, the pre-chlorinator for the old plant and lighting. It must be noted that the Occupational Health and Safety Act consider the refueling/use of a gasoline engine within an enclosed building unsafe. The engine should be replaced with a diesel oil engine as discussed in our recommendations in Section H.

There is no emergency power supply to operate the post-chlorination facilities. The pre-chlorine dosage is increased during a power failure event to compensate for loss of post-chlorination. The pre- and post-chlorine residuals are measured with the DPD reagent and HACH DR 100 colorimeter and manual dosage adjustments are made as necessary.

A 68 kW Caterpillar Diesel Generator Model D318 supplies emergency power to old high lift pump No. 4. The present diesel oil storage tank is 1135 L (250 gallons). The diesel engine is in good operating condition.

The standby equipment is run every Wednesday for one hour.

- New Plant

There are no standby facilities available for the new section of the plant.

D.2.13 Daily Operators Duties

During the course of the day, the Operations staff perform the tasks listed in Table D-4.

D.2.14 Operational Problems

The supervisory control equipment and instrumentation at the Port Dover Water Plant is considered to be very limited. The operator is responsible for many decisions and actions using the information available and his own experience to judge what action would result in the best overall plant and system operation.

TABLE D-4

PORT DOVER WATER TREATMENT PLANT

SCHEDULE OF OPERATOR'S DUTIES

Area	Component
New low lift building	- check pump pressure - record temperature of raw water
Pre-chlorine room	- record weight of chlorine used and chlorinator setting
Old Plant Area	- obtain water sample from DWSP sample line to conduct jar tests in order to calculate PAC dosage as time permits - obtain water samples from original sample tap to measure and adjust pre-chlorine dosage - check and record amount of PAC used and meter stroke and speed setting - record pump running time, flow meter reading for new low lifts - switch pump sequencer for new low lifts - record pump run time and gross gallonage pumped for old low lifts - check pump pressure and record pump run time for old high lift pumps - backwash old filters - record back-wash pump run time - obtain water sample to measure and adjust post-chlorine residual
Old chlorine building	- adjust pre-chlorine dosage
New high lift area	- check pump pressure - record pump run time and flow in gallons - measure post-chlorine residual
Post-chlorine room	- record weight of chlorine used and chlorinator setting - change chlorine cylinders for pre- and post- as required
New clarifier building	- Conduct V/V test for new clarifier and, if necessary, adjust recirculation speed and blowdown times. **Note:** Since there is no sample taps on the old clarifier, a V/V test cannot be performed. The sludge recirculation speed of the old clarifier is selected based on the V/V test from the new clarifier. - refill old and new plant PAC day tanks as required

The plant is started and stopped automatically a number of times each day, depending on system demand. The number of stop/starts is not recorded. This mode of operation adversely affects the performance of the filters and clarifiers. The low lift pumps start as a function of clearwell level based on specific level points. High lift pumps are started and stopped based on the elevated tank level. At present, the flow to the filters is controlled by manually throttling the valve to the clarifier.

There is no flow recorder or rate controller on the existing raw water lines to the clarifiers. A rate of flow control valve should be installed and monitored to control the clarifier level. This will enable a continuous rate of flow through the plant and therefore no off/on operation would be necessary. This would significantly improve the performance of the plant. Dosage control based on flow for both chlorine and PAC should also be incorporated. We would recommend the complete review and/or modification of the plant instrumentation as described in Section G.

It is recommended that the existing plant instrumentation be upgraded. The level of sophistication of this upgrading would be dependent upon the wants and needs of the Region. The primary goal should be to ensure that the plant be placed into a continuous mode of operation as quickly as possible. This could be accomplished by first upgrading the new plant. The new plant requires the fewer number of upgrades and is capable of supplying the present system demand, the majority of the time. As system demand increases, the old section of the plant can be upgraded and incorporated into the supervisory system. A list of suggested instrumentation and control modifications at the water plant is shown on Table D-5.

D.2.15 Water Plant Recommendations and Conclusions

There have not been any major modifications to the plant since the expansion in 1976. The new section was constructed primarily as a separate plant with no attempt to integrate it with the old plant. The following modifications would greatly enhance the overall operation of the plant and have been prioritized as follows:

1. The plant presently operates on a stop/start mode of operation. Not only is this mode of operation "hard" on equipment, it also affects the disinfection and particulate removal efficiency. We would recommend the installation of rate of flow controllers to maintain a continuous rate of flow through the plant. The rate of flow control valves should be installed on the existing

TABLE D-5

PORT DOVER WATER TREATMENT PLANT

PROPOSED INSTRUMENTATION UPGRADE

		CONTROL	MONITOR	STATUS
1.	Intake well low level alarm			1
2.	Low lift flow		1	
3.	Low lift header valve control and position	1	1	
4.	Raw water turbidity		1	
5.	Pre-chlorine residual		1	
6.	PAC dosage control	1		
7.	Pre-chlorine dosage control	1		
8.	Clarifier rate of flow controller	2		
9.	Clarifier level alarm			2
10.	Filter influent level alarm			2
11.	Filter effluent turbidity alarm			2
12.	Post-chlorine dosage control (auto over-ride)	1		
13.	High lift pump suction well low level alarm			1
14.	Clearwell level		1	
15.	High lift flow		1	
16.	High lift discharge header pressure		1	
17.	Plant effluent turbidity		1	
18.	Plant effluent chlorine residual		1	
19.	Waste water chamber level			1
20.	Chlorine gas leak		1	

raw water lines to the clarifiers to control the clarifier levels. This modification would ensure a continuous flow through the plant based on clearwell level and eliminate the present stop/start mode of operation.

2. Not all of the filters are operated simultaneously. One of the old filters and two of the three new filters are operated on a daily basis. The filters are sequenced to maintain approximately equal run times. It would be beneficial to operate all filters whenever possible. This would reduce the filtration rates, hence greatly improve filtration efficiency. This would also minimize the number of stop/starts.

3. One of the major components in the water plant with operational problems is the old filters. A number of upgrades are required to improve the overall operational efficiency. The following recommendations are related to the old filters. The upgrades should include the following:

   a) Surface or auxilary wash systems for gravity type filters without air scour systems should be utilized. The efficiency of the backwash system would be improved with a surface sweep system to loosen material for backwashing.

   b) The rate of flow control syphons are not working properly. The depth of water above the filter media was only 300-400 mm (12"-18") during our site visit. The water stains on the walls indicate that the level has been higher. We would recommend the repair or replacement of the rate of flow control syphons in order to maintain a stable, level of water in the filters.

   c) The filter media in the old filters has not been replaced since 1954. We would recommend characteristic testing (uniformity coefficient, effective size) be conducted. The results would indicate whether the media should be replaced. It is also recommended that the filter media be checked and sized on a regular basis as part of an on-going maintenance program.

   d) The backwash pump for the old filters has a high flow rate for the filters. The backwash rate is 68 m/hr, which exceeds the Ministry of the Environment acceptable rate of 45 m/hr. We would recommend that a capacity check be conducted on the pump and the rate of flow be adjusted accordingly with a rate of flow controller. The backwash

rate should be adjusted to a rate no greater than 7776 m^3/d which would be equivalent to a backwash rate of 45 m/h for the old filters.

4. We would recommend consideration be given to the interconnection of the two high lift discharge lines. This will eliminate the need to purchase a second turbidimeter and flow meter.

5. We would recommend a complete review of the post-chlorination system as described in Section F. The post-chlorine should be applied at a common point in the reservoir and a series of baffles installed to ensure sufficient mixing.

6. Over the past few years a number of report forms have been used for data collection. We would recommend the development of a standard report for data collection. The form should detail information required to evaluate the overall particulate removal and disinfection efficiency.

7. The present intake valve arrangement requires the entire plant to be shut down in the event the old plant must be isolated. An isolating valve should be installed on the section of intake leading to the new intake wet well to operate the plant on a continuous basis.

8. The use of the gasoline powered engine within an enclosed building is considered unsafe and should be replaced. A larger diesel fuel storage tank may be required, depending on the fuel requirements of the selected diesel engine. The present tank is 1136 L (250gallons).

D.3 DOAN'S HOLLOW INFILTRATION GALLERY

Doan's Hollow Infiltration Gallery was the only source of supply for the Town of Port Dover until the water plant was constructed in 1954.

Doan's Hollow Infiltration Gallery is unmanned. An operator inspects the gallery three times per day during weekdays and two times per day on the weekend. The operator measures the chlorine residual, the daily chlorine consumption measured in pounds, and the time of recording. This system consists of a series of tile beds which collect water that has infiltrated through the soil behind an impondment. The location and extent of the tile beds is unknown. The water collected from the tile bed is drawn by gravity through a 150 mm (6") cast iron pipe to a pump house at the dam. There is a by-pass valve connection between the dam and the 150 mm (6") cast iron pipe.

The raw water is chlorinated with sodium hypochlorite by a Liquid Metronics chemical feed pump model A121-91T rated at 109 L/d (24 gpd). The chlorine dosage is manually adjusted based on the chlorine residual measured. A stainless steel sample tap is located on the discharge side of the system pump.

Water is pumped to the system by a Babcock Centrifugal pump rated at a capacity of 2290 m^3/d (350 igpm) through a 150 mm (6") line which is connected to the 200 mm (8") line on Hwy No. 3. The pump is either turned on or off locally or from the water plant. The pump can also be controlled by the tank level.

After the water plant expansion in 1976, Doan's Hollow was run intermittently to supplement periods of high demand. In 1986, it was decided to operate Doan's Hollow 24 hours per day since it could meet system demands and the energy and chemical requirements were less than the water plant. A liquid chlorine, in the form of sodium hypochlorite, system was installed in May of 1986 and a flow meter was installed in September of the same year.

The chlorine residual of the treated water is measured three times per day during the week and twice a day on the weekends, using a DPD reagent and a portable HACH DR 100 analyzer. The Ministry of Health analyze for total and fecal coliform on a weekly basis and the results for 1986 are summarized in Table 7.0 of Appendix 3. There were no other microbiological tests conducted by Ministry of Health or the Regional Municipality of Haldimand-Norfolk. The Ministry of the Environment includes microbiological parameters testing as part of the DWSP.

Doan's Hollow does not have any alarm system or standby power capabilities.

D.3.1 Doan's Hollow Infiltration Gallery Recommendations and Conclusions

The Region of Haldimand-Norfolk have found Doan's Hollow Infiltration Gallery as an economical source of water. The gallery is still used as a base supply even though the water plant can meet the present system requirements. If the Region wishes to continue using Doan's Hollow Infiltration Gallery as a water supply, a further study should be conducted. The study should:

i) determine the extent and condition of the tile bed in order to repair damages and/or modify or extend the tile bed system;

ii) define the drainage area and investigate any herbicides or pesticides that may be used on crops or other possible contaminants that may enter the watercourse;

iii) conduct water quality testing to determine what treatment processes are required to operate Doan's Hollow within ODWO. (This testing is currently being conducted under the Drinking Water Surveillance Program.)

In the interim, the following modifications are required to operate Doan's Hollow until the above study is completed:

a) The chlorine system should be modified to lengthen the chlorine contact time. The chlorine application point should be changed from the discharge side of the pump to the clearwell and a longer piping system installed that would loop back and forth before distribution to the system. As this recommendation proceeds, a detailed design alternative would be prepared.

b) The by-pass valve on the 150 mm cast iron gravity intake should be removed. This would ensure that only infiltrated water enters the water system.

c) There is another valve located, on the side of the reservoir adjacent to the pond, which should be sealed. This would ensure pond water does not seep into the reservoir.

SECTION E

PARTICULATE REMOVAL

SECTION E

PARTICULATE REMOVAL

E.1 TURBIDITY REMOVAL

E.1.1 General

Liquid poly-aluminum chloride (SternPAC) is used at the Port Dover Water Treatment Plant for the coagulation and flocculation of suspended solids to a size appropriate for physical treatment. SternPAC is supplied by Sternson. The Port Dover Water Treatment Plant was the first water plant in North America to utilize liquid PAC. During 1986 the PAC dosages ranged from 0.80 mg/L (May) to 22.7 mg/L (July).

E.1.2 Old Plant

SternPAC is injected at the discharge header of the old low lift pumps, after pre-chlorination, by a solution metering pump. The solution metering pump is manufactured by Liquid Metronics Inc. The pump has a rated capacity of 273 L/d. The metering pumps can supply 12.9 mg/L at an operating flow of 2614 m^3/d.

E.1.3 New Plant

SternPAC is injected by a Liquid Metronics solution metering pump at the inlet pipe upstream of the 90° bend by the clarifier. The pump has a rated capacity of 1100 L/d. The metering pump can supply 17.8 mg/L at an operating flow of 7630 m^3/d.

E.1.4 Doan's Hollow Infiltration Gallery

Particulate removal is not performed at Doan's Hollow Infiltration Gallery and will not be discussed in this study.

E.2 PLANT PERFORMANCE

The 1984 daily dosage rates cannot be calculated since the consumption was not recorded daily. In 1985 liquid PAC was used on the new section of the plant and powdered PAC was used in the old section of the plant. The PAC

dosages during 1985 varied between 3.20 mg/L to 61.50 mg/L. During 1986, PAC dosages varied between 0.80 mg/L to 22.7 mg/L.

The plant records and the Ministry of the Environment Laboratory Analysis Reports, summarized in Tables 2.1 and 5.0, of Appendix 3 indicate the raw water turbidity is at times higher than the Ontario Drinking Water Guidelines of 1 FTU for treated water. During 1984 and 1985, turbidity levels were measured with a Lisle Metrix turbidimeter. The unit was out of service after March 1985. The unit was repaired and installed in the old high lift discharge header in 1987. The plant records indicate that the raw water turbidity levels were greater than the Ontario Drinking Water Objectives of 1 FTU, 57 days out of 315 days reported in 1984 and 30 out of 54 days reported in 1985. The 1985 results are from the Spring when turbidity levels are normally higher. The on-site raw water turbidity levels varied between 0.18 FTU (February 1985) to 30.1 FTU (September 1984). The on-site treated water turbidity levels only exceeded the ODWO 2 days out of the 337 reported days during 1984 and 0 days out of the 56 reported days in 1985.

Jar-testing is conducted intermittently on site to determine the amount of coagulant required to produce a settleable flocc. The jar test results are not recorded.

It is difficult to evaluate the efficiency of particulate removal from the available information with any amount of confidence. Table E-1 is a summary of the number of days the raw and treated water turbidity levels were recorded during the period 1984 to 1986. The turbidity measurements during 1985 are intermittent since the turbidimeter was out of service.

The 1984 data had incomplete flow records and PAC dosage records. The raw water flow records are also questionable as discussed in Section B of this report. During 1984 powdered poly-aluminum chloride was used as the coagulant. The PAC was premixed in containers every few days and used in the same manner as the present liquid PAC system. The PAC dosages could only be calculated, averaged over a period of 2-4 days.

During 1985, the system was changed to a liquid PAC system.

There was no 1986 field turbidity measurements.

Raw water samples for turbidity level measurements were obtained from the intake wet well. The water samples were not representative of the quality of the

TABLE E-1

PORT DOVER WATER TREATMENT PLANT

SUMMARY OF NUMBER OF DAYS TURBIDITY MEASURED

	1986		1985		1984	
	RAW WATER	TREATED WATER	RAW WATER	TREATED WATER	RAW WATER	TREATED WATER
January	0	0	22	23	31	31
February	0	0	28	28	29	29
March	0	0	4	5	31	31
April	0	0	0	0	30	30
May	0	0	0	0	13	30
June	0	0	0	0	30	30
July	0	0	0	0	31	31
August	0	0	3	3	31	31
September	0	0	0	0	30	30
October	0	0	0	0	16	16
November	0	0	0	0	12	17
December	0	0	0	0	31	31
TOTAL	0	0	54	56	315	337

raw water since chemical treatment, i.e. pre-chlorine, is applied at the intake to the wet well which changed the condition of the water.

The PAC dosages during the study period are difficult to interpret because the raw water flows are questionable.

In order to fully evaluate the particulate removal efficiency, complete records should be properly maintained for the following parameters:

1) Raw water turbidity;
2) Clarifier water turbidity for both old and new plants;
3) Filtered water turbidity for both old and new plants;
4) Treated water turbidity;
5) Daily chemical dosages for both old and new plants;
6) Raw and treated water flows for both old and new plants;
7) Backwash flows for both old and new plants;
8) Clarifier sludge wastewater flows for both old and new plants.

E.3 TREATABILITY TESTING

Jar testing was conducted at the water plant during the course of the study. Jar testing procedures were in accordance with the industry accepted practice - Standard Methods.

The following jar test results are based on samples obtained from the raw water sample taps installed in March 1987 as part of the Drinking Water Surveillance Program. The test results are as follows:

JAR-TESTING RESULTS

DATE OF TEST	RAW WATER TURBIDITY FTU	OPTIMUM RAW WATER TEMPERATURE °C	TREATED COAGULANT DOSAGE mg/L	WATER TURBIDITY FTU
July 13/87	14	20	3.9	0.20
July 15/87	16	19	3.9	0.15
July 17/87	5	19	5.0	0.09
July 21/87	11	21	4.0	0.17
July 23/87	15	21	3.0	0.13

Given the circumstances in these data, viz higher coagulant doses for a raw water turbidity of fewer than sixteen, the operators feel that selection of coagulant dose based on their experience is more appropriate than that indicated by jar test. This approach has worked and is evidenced by the acceptable treated water turbidity levels.

There is insufficient recorded testing to confidently evaluate jar testing at the water plant.

The Ministry of the Environment have also conducted jar testing studies at the Port Dover Water Plant. The draft report can be found in Appendix 2.

As part of this study, preliminary jar tests were conducted to determine optimum coagulant dosages and suitable coagulant aids. Based on this preliminary work, five final runs were selected, the five runs were as follows:

SUMMARY OF FINAL RUNS

RUN NO.	COAGULANT	DOSAGE (mg/L)	COAGULANT AID	DOSAGE (mg/L)	pH ADJUSTMENT	DOSAGE (mg/L)
1.	PAC	6	None	-	None	-
2.	PAC	10	Percol LT25	0.5	None	-
3.	Alum	20	Magnifloc	0.5	None	-
4.	PAC	12.5	Percol LT25	0.5	H_2SO_4	20
5.	PAC	10	Activated Silica	5.0	None	-

Run No. 5 produced a treated drinking water with the best overall qualities of the five treatments. The report also concluded that because of the unreliable colour results and inconsistent aluminum results of run No. 5, further investigation was required before excluding the other treatments as suitable for this raw water source.

E.4 OPTIMUM REMOVAL STRATEGIES

The plant's operations staff have effectively reduced turbidity levels to within the Ontario Drinking Water Objectives (ODWO) with the available equipment. The treated water turbidity was within the ODWO 391 out of 393 reported days during 1984 and 1985. The operations' staff have modified the existing facility

to improve particulate removal performance. The PAC application point in the new plant was changed from the clarifier inlet well to the upstream end of the 90° bend of the influent pipe to the clarifier which has improved the size of "floc" through better mixing and increased reaction time.

Further works are necessary to optimize particulate removal efficiency, and are summarized as follows:

1) It is recommended that first and foremost, that a standardized report format be developed to uniformly record daily information.

2) At present, a turbidimeter is in operation on the 300 mm (12") discharge line to the system. A turbidimeter was installed on this discharge line, since, high lift pump No. 5 is used as the base supply pump. If the level in the elevated tank drops to a preset level, high lift pump No. 5 turns off and one of the three new high lift pumps feeding the 400 mm discharge line is started. We would recommend that the turbidimeter be relocated, in the event that the discharge lines are connected, to a common discharge point. This would eliminate the need for a second turbidimeter in the new plant discharge line. This modification is necessary since under current Ministry Guidelines treated water turbidity levels must be continuously monitored. The interconnection of the two discharge headers would also eliminate the need to purchase a second flowmeter.

In order to fully evaluate the efficiency of the treatment units, turbidity measurements should be taken for the following:

Location	Frequency of Measurements
a) raw water line	daily
b) clarifier discharge lines	weekly and during extreme events
c) filtered water discharge lines	weekly and during extreme events
d) treated water discharge lines	continuously

3) The PAC system arrangement cannot immediately adjust to fluctuations in raw water turbidity. The metering pumps are manually adjusted depending on the treated water turbidity measurements. The Region has experimented with a Streaming Current Monitor (SCM). The unit has proven to be useful in optimizing coagulant dosages. An SCM would prove to be beneficial in optimizing particulate removal, especially since the plant is not manned 24 hours/day.

4) The following filter recommendations were described in Section D of this report. They have been reiterated in this section since they apply directly to particulate removal optimization. The recommendations are as follows:

   i) All filters should be operated at the same time. This would reduce filtration rates and minimize the number of filter stop/starts.

   ii) The rate of flow control syphons on the old filters should be repaired or replaced in order to maintain a stable level of water in the filters.

   iii) Characteristic testing should be conducted on the filter media on the old filters to determine whether they should be replaced.

   iv) A capacity check on the backwash pump should be conducted and the rate of flow adjusted accordingly with the installation of a rate controller.

   v) A surface wash or auxiliary wash system should be installed to loosen material during backwashing.

E.5 CONCLUSIONS

In general, the raw water turbidity is normally low and at times of high turbidity, the existing plant facilities reduced turbidity levels to within Ontario Drinking Water Objectives.

In order to assess particulate removal efficiency of the various components, it is necessary to have available consistent data for raw water turbidity/solids; treated water turbidity/solids; coagulant dose and dose/solids relationship. In the absence of these data it is not possible to provide a quantitative assessment of particulate removal efficiency. Based on the available treated water turbidity data, it is possible to make the general qualitative assessment that the plant performance is adequate, since treated water turbidity is consistently below the established limit of 1.0 FTU.

It must also be concluded that the recorded PAC dosages are difficult to interpret because the raw water flows are questionable. The implementation of the recommendations in Section G regarding the flow meter calibration and pump capacity check will enable the calculation of accurate PAC dosages.

SECTION F

DISINFECTION PRACTICES

SECTION F

DISINFECTION PRACTICES

F.1 GENERAL

Chlorine gas is used in the water treatment process for the disinfection of the water supply.

F.2 DISINFECTION PRACTICE

F.2.1 Water Plant

Raw water is disinfected with a chlorine gas solution. There are three pre-chlorinators each with a capacity of 11.3 kg/d (25 lbs/d). One pre-chlorinator applies chlorine on the discharge side of the old low lift pumps at a maximum rate of 4.3 mg/L based on the capacity of one old low lift pump in operation. Prior to the initiation of the DWSP in March 1987 at Port Dover, pre-chlorine was applied in the old wet well. Raw water samples for chlorine residual measurements were obtained from the discharge of the old low lift pump discharge header when in operation. No raw water samples can be obtained from the new low lift pumps because the sample taps are located after chlorination. Since the old low lift section is used as a base supply, there is no problem obtaining raw water samples from flowing pipes.

In the new plant, the chlorine gas solution is applied in the wet well at a maximum rate of 1.48 mg/L based on two new low lift pumps in operation.

The third pre-chlorinator is a standby unit.

The pre- and post-chlorine residual is measured three times per day during the week and twice a day on the weekends using a DPD reagent and HACH DR100 colorimeter. Depending on the measured residual, the chlorine dose is manually adjusted.

Filtered water is chlorinated in the clearwell before being pumped to the distribution system. Post chlorine is applied through a PVC diffuser surrounding the new high lift intake well. The post-chlorination system should be examined and modified. The chlorine contact time is minimal when the new high lift pumps are in operation since the water is pumped to the system as soon as it is chlorinated. There is insufficient chlorine dosage when the old

high lift pumps are in operation with the old section of the plant since the chlorination takes place in the new section of the clearwell.

The chlorinator has been fitted with a rotameter with a capacity of 90 kg/d (200 lb/d). The chlorinator has a capacity of 10.7 mg/L at a flow of 8500 m^3/d (i.e. capacity of one new high lift pump). Post chlorine is applied when the low lift pumps are in operation. Treated water samples for chlorine residual measurements are obtained from the header in operation at the time. The chlorine residual measurement is conducted three times per day during the weekdays and twice a day on the weekends. Depending on the measured residual, the post chlorine dosage is manually adjusted.

F.2.2 Doan's Hollow Infiltration Gallery

Raw water is chlorinated with Sodium Hypochlorite, by a Liquid Metronics chemical feed pump rated at 109 L/d (24 gpd). Sodium hypochlorite is a 12% chlorine solution. Therefore the maximum application rate based on 2290 m^3/d flow (capacity of system pump) is 5.7 mg/L as chlorine. The chlorine residual is measured three times per day during weekdays and twice a day on the weekends with a DPD reagent and HACH DR100 colorimeter. Samples are taken from the DWSP stainless steel sample taps installed in March 1987. The chlorine dosage is manually adjusted depending on the results of the chlorine residual test.

F.3 DISINFECTION EFFICIENCY

F.3.1 Water Plant

During 1986, the Ministry of Health, London Office analyzed 198 samples; 98 raw water samples and 100 treated water samples, from the Port Dover Water Treatment Plant. The following Table F-1 was derived from Table 7.0 of Appendix 3.

TABLE F-1

PORT DOVER WATER PLANT
SUMMARY OF BACTERIOLOGICAL TESTING (1986)

	TOTAL COLIFORM NUMBER OF SAMPLES			FECAL COLIFORM NUMBER OF SAMPLES	
MPN	RAW	TREATED	MPN	RAW	TREATED
Absent	24	100	Absent	92	102
1-100	70	0	2-10	3	0
101-5000	4	0	11-500	5	0
>5000	0	0	>500	0	0
Total Number of Samples	**98**	**100**		**100**	**102**

The raw water samples for bacteriological analysis were obtained by operations staff from the new wet well. The results are not representative of the actual bacteriological condition of the raw water since the raw water had already been chlorinated at times. The results do however, indicate the presence of fecal coliform and total coliform. Results from the DWSP in 1987 have indicated the CT/100 mL of total coliform varied between 0 and 3200 while the CT/100 mL of fecal coliform varied between 0 and 159.

The chlorination system effectively reduced the bacteriological levels of the treated water within the Ontario Drinking Water Objectives of a MPN less than 5 for total coliform and 0 for fecal coliform.

The Ministry of Health do not analyze for fecal strep in the raw or treated water from the Port Dover Water Treatment Plant.

The Drinking Water Surveillance Program was implemented in March 1987 at Port Dover Water Treatment Plant and Doan's Hollow Infiltration Gallery and includes testing for microbiological parameters.

A summary of disinfection parameters for 1986 were as follows:

i) the pre-chlorine demand varied between 0.16 mg/L (March) to 2.01 mg/L (February);

ii) the pre-chlorine dosage varied between 0.74 mg/L (March) to 2.58 mg/L (February);

iii) the post-chlorine dosage varied between 0.09 mg/L (December) to 1.42 mg/L (August);

iv) the free post-chlorine residual varied between 0.05 mg/L (April) to 1.30 mg/L (August).

The chlorine demand is greater during the summer months as a result of increased algae growth in warmer waters. There have been cases of taste and odour problems associated with algae during late July and early August. The post-chlorine dosage was increased and the filters were more frequently backwashed in order to reduce the occurrence of taste and odour problems.

Table 3.0 of Appendix 3, Disinfection Summary, indicates the plant personnel have not always been able to maintain a sufficient post-chlorine residual. The post-chlorine residual during 1986 varied between 0.05 mg/L in April to 1.30 mg/L in August. It is desirable to maintain a free chlorine residual of 0.50 mg/L at a contact time of 20 minutes.

F.3.2 Doan's Hollow Infiltration Gallery

During 1986, the Ministry of Health, London office, analyzed 119 water samples from Doan's Hollow Infiltration Gallery. The operators obtained samples from a tap on the suction side of the system pump. The treated water samples were obtained from a sample tap connected approximately 18 metres (60 ft) downstream of the system pump. The results summarized in Table F-2 are from Appendix 3.

TABLE F-2

DOAN'S HOLLOW INFILTRATION GALLERY
SUMMARY OF BACTERIOLOGICAL TESTING (1986)

	TOTAL COLIFORM NUMBER OF SAMPLES			FECAL COLIFORM NUMBER OF SAMPLES	
MPN	RAW	TREATED	MPN	RAW	TREATED
Absent	0	54	Absent	2	60
1-100	29	6	1-10	19	0
101-5000	30	0	11-500	39	0
>5000	0	0	>500	0	0
Total Number of Samples	**59**	**60**		**60**	**60**

There were 30 raw water samples where the total coliform exceeded a MPN of 100 and 39 cases where the MPN of fecal coliform exceeded 10. Of the six treated water samples with total coliforms present, four samples exceeded the ODWO of 5.

Since the incorporation of Doan's Hollow onto the DWSP in March 1987, bacteriological analysis have been conducted three times and the results have varied as follows:

Raw water total coliforms (CT/100 mL):	0-9400
Treated water total coliforms (CT/100 mL):	8-1600
Raw water fecal coliforms (CT/100 mL):	6-30
Treated water fecal coliforms:	present in 2 of 3 samples

The raw water DWSP samples were obtained from the stainless steel sample tap located on the suction side of the system pump before pre-chlorination. The DWSP treated water samples were obtained from a stainless steel tap on the discharge side of the system pump.

The treated water bacteriological parameters are more predominant in the DWSP results because of sample tap locations. The DWSP taps are located within 3 metres of chlorination and therefore has minimal contact time compared to the original taps located 18 metres downstream.

A summary of disinfection parameters for 1986 were as follows:

i) the chlorine demand varied between 0.03 mg/L (December) to 3.66 mg/L (June);

ii) the chlorine dosage varied between 0.54 mg/L (April) to 4.16 mg/L (June);

iii) the free chlorine residual varied between 0.05 mg/L (July) to 1.8 mg/L (June).

The results indicate that:

a) The chlorine demand is generally higher in summer months. This is a result of warmer waters promoting algae growth and therefore increasing chlorine demand.

b) The present solution metering pump has sufficient capacity to meet chlorine demands.

c) The free chlorine residual has been very low. It is desirable to maintain a free chlorine residual of 0.50 mg/L at a contact time of 20 minutes.

F.4 CHLORINATED BY-PRODUCTS FORMATION

F.4.1 Water Plant

Trihalomethane (THM) testing was not conducted at the Port Dover Water Plant until the DWSP tests began in March 1987.

The THM levels form part of the DWSP and results to date are summarized as follows:

SAMPLE DATE	TRIHALOMETHANE (PPB) RAW	TRIHALOMETHANE (PPB) TREATED	RAW WATER COLOUR (HZU)	RAW WATER TURBIDITY (FTU)
March 3, 1987	0.000	56.00	3.00	4.10
April 27, 1987	1.500	58.00	4.00	0.47
May 25, 1987	0.000	45.15	0.50	1.92
June 22, 1987	0.500	64.70	1.00	1.60
July 27, 1987	0.000	53.50	3.00	6.10

The Ministry of the Environment have tested for THM's at a number of water plants located on Lake Erie as part of their "1977-1982 Survey of Selected Water Treatment Plants". The water plants; Amherstburg, Harrow-Colchester, Leamington-Union, St. Thomas-Elgin, Port Colbourne and Fort Erie reported trihalomethane levels less than 30 ppb based on the Direct Aqueous Injection (DAI) method. The DAI method results were generally 1.26 to 3.88 times greater than levels measured by the purge and trap method.

The Ministry of the Environment Ontario Drinking Water Guidelines limit for trihalomethanes is 350 ppb based on the purge and trap method. The reported levels are greater than levels in and around other Lake Erie water plants. We would expect at this point in the Study that the THM levels will be in the range of 40-70 ppb until a more extensive data base is formed.

F.4.2 Doan's Hollow Infiltration Gallery

Trihalomethane (THM) testing was not conducted at Doan's Hollow Infiltration Gallery prior to the DWSP testing in March 1987.

The following THM levels form part of the DWSP data base and the results to date are summarized as follows:

	TRIHALOMETHANE (PPB)		RAW WATER	
SAMPLE DATE	RAW	TREATED	COLOUR HZU	TURBIDITY FTU
March 23, 1987	0.000	33.000	5.0	0.660
April 27, 1987	0.000	28.000	5.5	1.090
June 22, 1987	0.000	29.700	2.5	0.830

The results to date are consistent and vary between 28 to 33 ppb. A more extensive data base will be required to draw conclusions on the THM levels for the water at Doan's Hollow.

F.5.1 Water Plant

There are modifications and equipment required to upgrade the operation of the water plant as well as guarantee proper disinfection of the water supply.

i) The screens, pump screen and piping on the new low lift building have been corroded. The chlorine injection point should be relocated from the wet well to the discharge side of the low lift pumps in order to eliminate the corrosion problem.

ii) At times, the pre-chlorinators have approached their capacity and the operators have had to reduce the flow into the plant. It is evident, that the capacity of the pre-chlorinators should be increased. In order to minimize costs, the present pre-chlorinator should be switched as a post-chlorinator, and the post-chlorinator used as a pre-chlorinator. This would necessitate the need for only one additional pre-chlorinator.

iii) The chlorine residual analyzer should be repaired or replaced, to enable plant staff to optimize chemical dosage and ensure an adequate chlorine residual in the treated water.

iv) We would recommend a complete review of the post chlorination system. The post chlorine should be applied at a common point in the reservoir and a series of baffles should be installed to ensure sufficient mixing.

F.5.2 Doan's Hollow Infiltration Gallery

If Doan's Hollow is to continue to operate as a source of supply for Port Dover, the following improvements are required:

i) The present plant arrangement makes it difficult to increase the chlorine contact time. One possible alternative would be to install a piping arrangement to increase the contact time before water is pumped to the distribution system. The discharge pipe could be arranged to loop back and forth in the yard before water is distributed to the system.

ii) The by-pass valve on the 150 mm cast iron gravity intake should be removed and the sheer gate on the side of the dam adjacent to the pond should be sealed to ensure pond water does not enter the system.

F.6 CONCLUSIONS

F.6.1 Water Plant

At this point in the study, we would conclude that:

i) The treated water appears to be properly disinfected;

ii) The chlorine residuals tend to be less than the desirable 0.5 mg/L; and

iii) The expected trihalomethane levels will be in the range of 40-70 ppb dependent on raw water quality. We do not expect treated water trihalomethane levels to exceed the Ontario Drinking Water Objectives.

The possibility of considering other feasible disinfection alternatives, is limited by the lack of testing for chlorinated by-products. These alternatives should be considered part of the MOE Study on Alternative Disinfectants which is to provide information on the use of Chlorine, Ozone, Chlorine Dioxide etc.

F.6.2 Doan's Hollow Infiltration Gallery

At this point in the study, we can conclude that:

a) The water is not always properly disinfected. 2 samples of 60, or 3%, were not properly disinfected.

b) The chlorine residual varied considerably and tended to be less than the desirable 0.5 mg/L.

c) The expected THM levels should be in the range of 25 to 35 ppb.

d) There is insufficient contact time between chlorine application point and the first consumer.

SECTION G

SHORT TERM MODIFICATIONS

SECTION G

SHORT TERM MODIFICATIONS

G.1 GENERAL

In this section of the report we have examined the necessary short term plant improvements to optimize disinfection and particulate removal. In accordance with generally accepted practice, the construction of works required to modify the plant to recommended guidelines/capacity should be divided into various stages to construct the facilities no earlier than necessary. The improvements should include all works required either immediately or in the very near future. The works should be staged to first improve the new section of the water plant since the new plant is capable of supplying the present maximum day demand. As demand increases, the proposed works on the old plant should proceed. This work should include:

-WATER PLANT

a) DISINFECTION/PARTICULATE REMOVAL

- standard Operational Procedures
- development of a standard report form
- plant process and piping diagram
- re-calibration of instruments and determination of equipment capacities
- interconnection of high lift discharge headers

b) DISINFECTION

- change pre-chlorine application point in new plant
- repair of post-chlorine residual analyzer
- modifications to pre-chlorination system
- review and modify post-chlorination system

c) PARTICULATE REMOVAL

- laboratory equipment - pH meter
- operate all filters
- examine and upgrade Old Filters

i) examination and, if necessary, replacement of filter media
ii) repair or replace rate of flow control syphons
iii) surface wash system
iv) backwash rate controller

-DOAN'S HOLLOW INFILTRATION GALLERY

a) DISINFECTION
- relocation of chlorine injection point
- calibration of flow meter and determination of pump capacity
- removal of valves in detention pond
- raw water quality testing

It is important to note that at the time of publication of this document, certain recommended modifications and studies might have been initiated and/or completed.

G.2 WATER PLANT

G.2.1 Disinfection/Particulate Removal

Throughout the study it was noted that different operators had established their own operational procedures (e.g. sludge blowdown procedures, selection of PAC dosages). We would recommend standard operational procedures be established to ensure that operators follow a set procedure. The procedures should outline the basis to operate the plant continuously.

G.2.1.2 Report Form

Up to date plant records must be maintained in order to fully evaluate a plant's performance. A standard report form should be developed to detail pertinent quantitative and qualitative information.

G.2.1.3 Plant Process and Piping Diagram

The existing drawings of the water plant do not provide sufficient detail of the interrelationship of all process and piping components. A detailed process and piping diagram should be drafted. The diagram would be beneficial for the proposed plant modifications.

G.2.1.4 Calibration of Instruments and Determination of Pump Capacities

The flow meters have not been re-calibrated nor have the capacity of the pumps been re-checked for some time. In order to optimize plant performance in terms of chemical application, filter backwashing, etc., a complete re-calibration of instruments and determination of pump capacities should be undertaken.

G.2.1.5 Interconnection of High Lift Discharge Headers

The two discharge headers should be interconnected. The relocation of the flow meter and turbidimeter to a location common to both discharges would enable the operators to utilize existing equipment without the need to purchase additional equipment.

G.2.2 Disinfection

G.2.2.1 Change of Pre-Chlorine Application Point

The screens, piping, and pump screens have corroded because of the application of chlorine in the new intake wet well. We would recommend the chlorine application point be changed to the discharge side of the new low lift pumps.

G.2.2.2 Repair of Post-Chlorine Residual Analyzer

It is a Ministry of the Environment policy to continuously monitor the post-chlorine residual. The analyzer frequently breaks down during winter months when the temperature within the building becomes very low. This unit should be repaired and placed back into service. We would also recommend unit heaters be installed in the main building before next winter to maintain warm temperatures.

G.2.2.3 Modification to Pre-Chlorination System

It was noted in Section F of this report that the pre-chlorinators at times were approaching their capacity. We would recommend that the two pre-chlorinators be switched to provide for post-chlorine application and the post-chlorinator be switched to become a pre-chlorinator necessitating the need for only one additional pre-chlorinator.

G.2.2.4 Review and Modifications to the Post-Chlorination System

Post-chlorine is applied through a PVC header surrounding the new high lift suction well. This results in minimal detention time when the new high lift pumps are operated and possibly no post-chlorination when the old plant is operated. The post-chlorine application point should be relocated to a common point and baffles installed to ensure sufficient mixing and contact time.

G.2.3 Particulate Removal

G.2.3.1 Install pH Meter

It is a minimum requirement under the Ministry of the Environment Guidelines for the Design of Water Treatment Works to provide equipment for the determination of hydrogen ion concentration in the pH range of 4-10. This equipment would be beneficial in the determination of optimum coagulant doses.

G.2.3.2 Operate Old Filters

All filters should be operated at one time. This would reduce filtration rates and minimize the number of stop/starts.

G.2.3.3 Examine and Upgrade Old Filters

a) Study of Filter Media

Core samples of the old filters should be obtained and tested to determine the uniformity coefficient and effective size. We believe that due to the age of the media and reports of "mud balls" that the filter media will have to be replaced.

b) Rate of Flow Control Syphons

The rate of flow control syphons should be repaired or replaced. They are required to maintain a stable level of water in the filters.

c) Surface Wash Systems

The old filters should have surface or auxiliary wash systems installed to loosen material for backwashing.

d) Backwash Rate Controller

The backwash rate for the old filters exceeds the Ministry of the Environment Guidelines for the Design of Water Treatment Works. A rate controller should be installed to control the backwash rate.

G.3 DOAN'S HOLLOW INFILTRATION GALLERY

G.3.1 Disinfection

G.3.1.1 Change of Chlorine Application Point

There is insufficient contact time between the point of chlorine application and the first consumer. The chlorine application point should be changed from the pump discharge to the clearwell and a piping arrangement installed to increase the chlorine contact time. A pipe could be looped back and forth from the plant before the water is distributed to the system. The longer chlorine contact time would also ensure representative DWSP bacteriological results.

G.3.1.2 Calibration of Flow Meter and Determination of Pump Capacity

Since the installation of the flow meter, flows have been 25% greater than previously reported. The pump should be re-checked for capacity and the flow meter re-calibrated.

G.3.1.3 Removal of Valves in Detention Pond

The by-pass valve located in the pond adjacent to the dam and the valve on the side of the plant should be removed. This will ensure that only infiltrated is water entering the system.

G.3.1.4 Raw Water Quality Testing

Prior to the DWSP very little information on Doan's Hollow water quality was available. We would recommend raw and treated water testing be continued under DWSP if Doan's Hollow is to continue to supply potable water to the Town of Port Dover.

SECTION H

LONG TERM MODIFICATIONS

SECTION H

LONG TERM MODIFICATIONS

H.1 GENERAL

This section of the report examines the long term plant improvements to upgrade the Water Plant and Doan's Hollow Infiltration Gallery. The improvements are aimed at providing the water plant with the proper equipment to operate continuously and shall include the following work:

Water Plant
- installation of an intake valve
- replacement of the gasoline powered generator
- construction of a chemical building
- plant automation
- installation of a Streaming Current Monitor
- paving of access driveway

Doan's Hollow Infiltration Gallery
- a detailed study on Doan's Hollow Infiltration Gallery

H.2 WATER PLANT

H.2.1 Intake Valve

A valve should be installed on the intake to the new wet well. This would permit isolation of either section of the water plant. This would also eliminate the need to shut down the plant when the new wet well is cleaned.

H.2.2 Replacement of Gasoline Powered Generator

The use of gasoline powered combustion equipment within confined areas is prohibited. For this reason, we would recommend the replacement of the 35 kW gasoline powered generator with a stand-by diesel generator set of sufficient size to run various other components such as lighting, heating, chlorinators, metering pumps, etc.

H.2.3 Chemical Building

We would recommend that a proper chemical facility be constructed in the main building. The pre-chlorination facilities are housed in a wooden structure at the back of the building. The post-chlorination facilities are housed in a separate room at the front of the building. Poly aluminum chloride is stored in the new clarifier building near the top of the hill and must be manually hauled to the old plant on a daily basis. The accepted practice is to house the chemical facilities in a properly constructed room with proper ventilation, air breathing equipment, eyewash/deluge showers and adequate facilities for cleaning up spills.

H.2.4 Plant Automation

A detailed plan should be developed to automate the plant. The plan should include the necessary facilities to allow plant operation on a continuous basis based on the system demand. As a preliminary review, we have prepared under Section D.2.14 a summary of what we consider to be the necessary instrumentation upgrades for this facility.

H.2.5 Streaming Current Monitor

The Region have reported improved efficiency in particulate removal during their pilot study use of a Streaming Current Monitor and consideration should be given to installation of one at the plant.

H.2.6 Paving of Access Driveway

At present, chemicals are delivered every 2 to 3 months requiring delivery during winter months. The driveway is of gravel and dirt, and winds down the hill to the plant. The operators report delivery trucks have difficulty driving up and down the driveway during winter months. We would recommend the driveway be paved to prevent accidental spills and ensure a sufficient supply of chemicals to the plant.

H.3 DOAN'S HOLLOW INFILTRATION GALLERY

A further study on Doan's Hollow Infiltration Gallery should be undertaken if it is to continue as a water supply to the Town of Port Dover. The study should:

a) determine the extent and condition of the tile bed in order to repair damages and/or modify or extend the tile bed system;

b) define the drainage area and investigate any herbicides or pesticides that may be used on crops or any other contaminants that may enter the watercourse.

APPENDICES

APPENDIX 1

PLANT WASTE STUDY

APPENDIX 1

PLANT WASTE STUDY

- General

The waste water treatment system is provided to handle wastewater produced by the treatment processes. There are three sources of waste from the plant:

1. material collected from intake screen;
2. filter backwash water;
3. clarifier sludge wastes.

The major volume of waste is generated from the filter backwash and clarifier sludge.

- Screen Wastes

Due to the nature of the raw water, there is very little material removed by the intake screen. The material primarily consists of small fish and weeds, etc. This material is disposed of through the garbage system and normally does not require a great deal of labour. The estimated volume of screen waste is less than 22 litres (5 gallon bucket) per week.

- Filter Wastes

The old filters are backwashed once per day. There is a single backwash pump with a capacity of 11 765 m^3/d (1800 igpm). The rate is sustained for a period of about 10 minutes. Assuming both filters were backwashed once every 24 hours, the amount of backwash water to Lake Erie is approximately 164 m^3/d.

The three new Graver filter units are backwashed once per day or once the headloss across the filter media reaches 1.5 m (5

ft.). Due to the nature of the raw water, the filters are normally backwashed daily. The backwash timer is set for 3 minutes at a flow rate of 11080 m^3/d (1095 igpm) for a total backwash volume of 69 m^3/d for the three filters. The backwash water is discharged to Lake Erie as described below.

At present, the filter backwash water for both old and new plants is discharged directly to Lake Erie through a corrugated metal pipe. The corrugated metal pipe is 1800 mm in diameter with an effective depth of 1.5 m (5 ft). The corrugated metal pipe is 18.3 m (60 ft.) in length with an effective volume of approximately 30 m^3. There have not been any chemical analyses of backwash waters to date. The corrugated metal pipe is divided into sections with each section acting as a settling basin and overflowing to the next section. The supernatant flows by gravity to Lake Erie. The sludge is then shovelled out and disposed of through the garbage system.

SLUDGE WASTE

Water plant sludge is generated from the clarifiers and is flushed to a sewage pumping station adjacent to the water plant. The sludge is then pumped through a 100 mm (4") forcemain to the sanitary sewage system by a Flygt CP3101-432 electric sewage pump. There is also an identical stand-by unit on site. There are no pump curves indicating the design capacity of the pump. We have calculated the operating capacity of the pump to be 1000 m^3/d (153 igpm) at 12.5 m (41 ft) head. The sewage pumping station is 1.83 m (6 ft) in diameter and has an effective volume of 4.1m^3 (145 ft^3). To date, there have not been any chemical analyses conducted on the clarifier

sludge or documented records of the amount of sludge generated from the water plant.

There is an overflow from the sewage pumping station to the corrugated metal pipe in the event the sewage pumps fail.

The Graver clarifier is cleaned once every 90 minutes for approximately 2 minutes at a rate of 7412 m^3/d (1134 igpm). Based on the above criteria, we estimate the Graver clarifier generates approximately 165 m^3/day of sludge wastewater. There are no operating manuals available for the old clarifier. Based on the Graver design criteria, we estimate the volume of sludge wastewater from the old clarifier to be approximately 84 m^3/d.

The normal daily wastewater volume with both clarifiers on a 90 minute "sludge blowdown" cycle and all filters being backwashed once per day is 482 m^3/d.

TREATMENT ALTERNATIVES

- Filter Backwash - Wastewater

The present 1800 mm diameter corrugated metal pipe could be modified to handle filter backwash wastes to the sewage pumping station. The existing sewage pump has sufficient capacity to handle the additional waste volume on a daily basis.

- Clarifier Sludges

The Port Dover Water Plant does not generate sufficient volumes of wastewater to economically consider coagulant recovery or a wastewater thickener as a viable treatment alternative. The use of a lagoon is limited by space around the plant and the close vicinity to residents. One viable alternative would be disposal of sludge at

a sanitary landfill site. Presently the closest site is the Tom Howe site, located approximately 9 kilometers from the plant.

CONCLUSIONS AND RECOMMENDATIONS

The summary of maximum daily wastewater volumes are listed in the following table:

Component	Rate (m^3/d)	Number of Units	Time of Cleaning (minutes)	Runs/Day /Unit	Volume of Wastewater
Old Clarifier	2614	1	2	16	84
New Clarifier	7412	1	2	16	165
Old Filters	11765	2	10	1	164
Old Filters with rate controller on old backwash pond	7776	2	10	1	108
New Filters	11080	3	3	1	69
Total Wastewater Volume					482
Total Wastewater Volume with Rate Controller on Old Backwash Pump					426

In the long term, it is recommended that all flows be discharged to the sewage system. The present corrugated metal pipe for filter wastes would have to be modified and expanded. Assuming only one filter is backwashed at one time, the volume of additional storage required would be approximately 40 m^3 which is the volume of wastewater from the largest component - one old filter backwashing. The additional volume required can be reduced to approximately 13 m^3 once the old filter backwash rate controller is installed.

APPENDIX 2

JAR TEST REPORT
WATER PLANT OPTIMIZATION STUDY

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WATER PLANT OPTIMIZATION STUDY
PORT DOVER - JAR TEST REPORT

Jar Test Conditions

The raw water source (Lake Erie) for the Port Dover Water Treatment Plant was sampled on June 2, 1987 and all jar testing was performed at 12°C on this sample. Raw water characteristics for that day are indicated on the table of results (Table 1). Sample aliquots, for preliminary work and final runs, were 500 mL and 3500 mL respectively. All samples for both preliminary and final runs were subjected to the same conditions. All chlorinated samples were allowed a contact time of 30 minutes. Chemical addition was followed by a flash mix time of one minute at 100 + rpm, 25 minutes for flocculation at 25 rpm and sedimentation for 30 minutes. Preliminary runs were filtered through Whatman 541 filter paper. Final runs were filtered through sand and anthracite (glass column) at a rate of 90 mL/min. which is equivalent to a 9 m/hr. filtration rate.

A 60 litre raw water sample was requested and received for the jar test evaluation. Raw and treated water samples from the plant were submitted for analysis (listed on Table 1) to the main lab. A raw water sample was also submitted June 12, 1987 for chemical analysis along with the samples generated by the final runs.

Preliminary Jar Tests

Initial jar tests were performed using polyaluminum chloride (PAC) which is the coagulant currently in use in the plant. Plant dosage at the time of sampling was 6.0 mg/L PAC, thus dosages ranging from 2.5 mg/L to 20 mg/L were tried first. The PAC dosage 2.5 mg/L produced a large quantity of very tiny pinfloc. Dosages from 5 mg/L to 20 mg/L produced numerous small, light, loose, fair quality floc. Visual observations, a supernatant turbidity of 0.13 FTU, a filtered turbidity of 0.09 FTU and an aluminum residual of 0.01 mg/L indicated that 20 mg/L was the optimum PAC dosage.

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To determine a suitable polyelectrolyte for use in conjunction with PAC, twelve different polymers were tried at a dosage of 0.5 mg/L. Percol LT25 appeared to be the best having produced medium sized, round, fairly compact, slightly sticky, good quality floc. Magnifloc A100 and A110 exhibited similar good quality floc and would make very good second choices.

The PAC dosage was optimized using the polymer Percol LT25 at a dosage of 0.5 mg/L and PAC dosages ranging from 10 mg/L to 22.5 mg/L. The floc produced by 10 mg/L PAC was medium, compact, fairly heavy, good quality floc. A supernatant turbidity of 0.19 FTU, a filtered turbidity of 0.13 FTU and an aluminum residual of 0.06 mg/L indicated 10 mg/L was the optimum PAC dosage for this run. The addition of a polymer reduced the optimum PAC dosage by half.

As an alternative coagulant, alum was tried at dosages ranging from 5 mg/L to 30 mg/L. All jars produced numerous, light, shapeless floc. A supernatant turbidity of 0.18 FTU, a filtered turbidity of 0.15 FTU and an aluminum residual of 0.35 mg/L indicated that 25 mg/L was the optimum alum dosage.

In order to determine a suitable polyelectrolyte for use with alum, twelve different polymers were tried at a dosage of 0.5 mg/L with the optimum alum dosage of 25 mg/L. The best polymer appeared to be Magnifloc 905N having produced medium to large, compact, uniform, fairly heavy, good quality floc. Magnifloc A100 produced similar floc and would make a very good second choice.

The alum dosage was optimized using the polymer Magnifloc 905N at a dosage of 0.5 mg/L with alum dosages ranging from 10 mg/L to 25 mg/L. Floc characteristics were not as good as the previous run at the same dosages. Floc produced by 20 mg/L alum with 0.5 mg/L Magnifloc 905N was medium, loose and sticky. A supernatant turbidity of 0.13 FTU and an aluminum residual of 0.06 mg/L confirmed that this was the optimum dosage.

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The pH was adjusted in an attempt to reduce the alum dosage and lower aluminum residual results. The addition of 20 mg/L H_2SO_4 prior to the addition of PAC reduced the pH from 8.33 to 6.80. PAC was then optimized using concentrations ranging from 10 mg/L to 15 mg/L with the polymer Percol LT25 at a dosage of 0.5 mg/L. The floc produced was looser and lighter than the floc exhibited by the same dosage without pH adjustment. Visual observations, a supernatant turbidity of 0.22 FTU, a filtered turbidity of 0.14 FTU and an aluminum residual of 0.45 mg/L indicated 20 mg/L H_2SO_4 with 12.5 mg/L PAC and 0.5 mg/L Percol LT25 was the optimum dosage for this run.

The pH was adjusted using alum as an alternative coagulant. Dosages of alum ranged from 15 mg/L to 25 mg/L. The floc produced by this run was of very poor overall quality and did not improve the physical characteristics of the floc produced by similar alum dosages without pH adjustment.

Activated silica was tried as an alternative to the use of a polyelectrolyte with both PAC and alum as coagulants. All jars produced small numerous light floc. Aluminum residuals were high, ranging from 0.16 mg/L to 0.45 mg/L. Both physical and analytical results were poor overall.

As another alternative coagulant, four jars using ferric chloride as the coagulant were run. Dosages ranged from 5 mg/L to 20 mg/L. All jars produced numerous light floc. The quantity of floc increased with an increase in the dosage. With a supernatant turbidity of 0.26 FTU, a filtered turbidity of 0.12 FTU and an iron residual of 0.09 mg/L the optimum ferric chloride dosage appeared to be 20 mg/L.

Several jars of alum and PAC combinations were tried. All jars produced fair quality, numerous, light floc. Further investigation was prevented, having exhausted the raw water sample.

Final Runs

Based on this preliminary work five final runs were selected, the results of which are indicated on Table 1 and Table 2.

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The raw water analyses indicated a raw water source of fairly good quality. Turbidity (10.7 FTU) and aluminum (0.14 mg/L) were the only parameters analysed that were excessive and would require removal to produce a treated drinking water supply in compliance with the Ontario Drinking Water Objectives (ODWO).

On June 12, 1987, the plant treatment process (06-P-T) consisted of the addition of 1.0 mg/L Cl_2 and 6.0 mg/L PAC. This treatment was duplicated and is represented by 09-P-1. Plant treated (09-P-T) and lab treated (09-P-1) samples generally showed very similar analytical results. However the plant treated (09-P-T) aluminum residual at 0.160 mg/L did not compare at all to the lab treated (09-P-1) at 0.028 mg/L. Preliminary tests predicted an aluminum residual of approximately 0.06 mg/L. Colour results were checked by the main laboratory and were judged to be unreliable but could not be repeated. Therefore the result of 5.0 TCU for 09-P-1 is anomalous and should not be considered as exceeding the ODWO requirements.

Treatment 09-P-2 (1.0 mg/L Cl_2 + 10 mg/L PAC + 0.5 mg/L Percol LT25) represents the optimum PAC dosage with the best polymer. Analytical results were very similar to 09-P-1. However the aluminum residual for 09-P-2 exceeded the ODWO requirements even though preliminary tests had predicted a much lower result.

Alum is used as an alternative coagulant and is represented by 09-P-3 (1.0 mg/L Cl_2 + 20 mg/L alum + 0.5 mg/L Magnifloc 905N). Analytical results are very similar to 09-P-1 and 09-P-2. Alkalinity is slightly lower as is expected when using alum rather than PAC as a coagulant. All critical analytical parameters analysed meet the ODWO requirements. The aluminum result is very close to the Maximum Desirable Concentration (MDC), allowing only a very small margin for day to day variation in the treatment process.

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Treatment 09-P-4 (20 mg/L H_2SO_4 + 1.0 mg/L Cl_2 + 12.5 mg/L PAC + 0.5 mg/L Percol LT25) uses pH adjustment in an attempt to improve physical floc characteristics and reduce aluminum residual results. All critical parameters analysed met the ODWO requirements. The aluminum residual is very close to the MDC and does not allow a large margin for day to day variation in the treatment process. The pH adjustment does not significantly improve physical floc characteristics or lower aluminum residuals.

Activated silica is used as an alternative coagulant aid in treatment 09-P-5 (1.0 mg/L Cl_2 + 10 mg/L PAC + 5.0 mg/L activated silica) with PAC as a primary coagulant. All parameters analysed meet the ODWO requirements. Colour is equal to the MDC but as previously mentioned the results are unreliable and should not be considered without confirmation by reanalysis. Aluminum residuals were well within the ODWO requirements. This treatment (09-P-5) produced a treated drinking water with the best overall qualities of the five treatments represented by final runs. However unreliable colour results and inconsistent aluminum results would indicate a need for further investigation before excluding the other treatments as suitable for this raw water source.

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TABLE 1
RESULTS OF CENTRAL LAB ANALYSIS

PLANT	SAMPLE	DATE	DESCRIPTION OF TREATMENT
Port Dover	09-P-R	2/6/87	Raw Water
	09-P-R	12/6/87	Raw Water
	09-P-T	2/6/87	Treated Water (Plant)
	09-P-1	12/6/87	1.0 mg/L Cl_2 + 6.0 mg/L PAC
	09-P-2	12/6/87	1.0 mg/L Cl_2 + 10 mg/L PAC + 0.5 mg/L Percol LT25
	09-P-3	12/6/87	1.0 mg/L Cl_2 + 20 mg/L Alum + 0.5 mg/L Magnifloc 905N
	09-P-4	12/6/87	20 mg/L H_2SO_4 + 1.0 mg/L Cl_2 + 12.5 mg/L PAC + 0.5 mg/L Percol LT25
	09-P-5	12/6/87	1.0 mg/L Cl_2 + 10 mg/L PAC + 5.0 mg/L Activated Silica

	Raw	Raw	Plant	Plant Simulation	PAC Poly	Alum Poly	Acid PAC Poly	PAC Act Si	
METALS	09-P-R	09-P-R	09-P-T	09-P-1	09-P-2	09-P-3	09-P-4	09-P-5	UNITS
Iron	.120		.003	.009	.016	.025	.004	.029	mg/L
Manganese	.005		<.001<W	.002	.001	.001	.002	.012	mg/L
Aluminum	.140		.160	.028	.110	.089	.091	.044	mg/L
Arsenic	<.001		<.001	<.001	<.001	<.001	<.001	<.001	mg/L
Copper	.001		<.001<W	.021	.024	.050	.120	.044	mg/L
Lead	<.003		<.003	<.003	<.003	.004	.003	<.003	mg/L
Zinc	.001		.001	.004	.003	.006	.012	.003	mg/L
General Chemistry									
Conductivity	309	303	312	301	305	306	322	316	µmho/cm
Hardness	132	131	131	126	129	129	130	127	mg/L
Calcium	38.6	38.6	38.4	37.0	38.0	38.0	38.4	37.4	mg/L
Magnesium	8.5	8.5	8.5	8.3	8.3	8.3	8.3	8.2	mg/L
Sodium	9.0	8.2	8.6	9.0	8.4	8.2	9.2	9.8	mg/L
Potassium	1.40	1.40	1.40	1.25	1.30	1.40	1.40	1.40	mg/L
Alkalinity	106.7	104.7	102.5	98.4	98.5	93.0	63.3	99.6	mg/L
pH	8.33	8.18	8.34	8.11	8.10	7.99	7.50	8.07	-
Chloride	15.5	14.9	18.2	17.3	18.2	16.0	18.9	18.5	mg/L
Sulphate	23.4	24.5	23.9	24.0	24.0	32.9	59.5	27.1	mg/L
Turbidity	10.70	4.30	.58	.16	.30	.16	.23	.41	FTU
True Colour	2.0<T	2.0<T	1.0<T	5.0	4.0	1.0<T	<.5<W	5.0	TCU
Total Phosphorus	.100	<.01<W	.070	<.01<W	<01<W	<01<W	<.01<W	<.01<W	mg/L
Total Kjeldahl	.50	.30	.40	.20<T	.20<T	.20<T	.20<T	1.10	mg/L
Ammonium	.15<T	.15<T	.20<T	.15<T	.10<T	.15<T	.10<T	.45	mg/L
Nitrates	.20<T	.15<T	.15<T	.10<T	.10<T	.10<T	.05<T	.05<T	mg/L
Nitrite	<.005<W	.07	.005<T	.01<T	.005<T	.01<T	.015<T	.01<T	mg/L
DOC	2.4	2.3	1.9	1.9	1.9	1.8	1.7	3.2	mg/L
Priority Organics									
Chloroform	<0<W		37	7	7	6	4	14	µg/L
Bromodichloromethane	<0<W		15	2	1	2	2	2	µg/L
Chlorodibromomethane	<0<W		5	<0<W	<0<W	<0<W	<0<W	<0<W	µg/L
Total Trihalomethanes	<0<W		57	9	8	8	6	16	µg/L

<T - Value recorded is below the usual reporting limit and is for information only (tentative)
<W - Less than the lowest detectable concentration.

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TABLE 2

FINAL RUNS PLANT: PORT DOVER DATE: JUNE 12, 1987

JAR #: 09-P-1 Representative of plant.	
TREATMENT: 1.0 mg/L Cl_2 + 6.0 mg/L PAC.	CHLORINE RESIDUAL: (mg/L) BEFORE COAGULATION: - Free 0.32 - Total 0.675 AFTER FILTRATION: - Free 0.05 - Total 0.20
COMMENTS AND DESCRIPTION: There was a large quantity of light small feathery floc produced. After sedimentation there was floc in supernatant.	pH 8.0 Alkalinity 96 Aluminum 0.01 mg/L Turbidity 0.12 FTU
JAR #: 09-P-2 Optimum alum dosage with best polymer.	
TREATMENT: 1.0 mg/L Cl_2 + 10 mg/L PAC + 0.5 mg/L Percol LT25.	CHLORINE RESIDUAL: (mg/L) BEFORE COAGULATION: - Free 0.20 - Total 0.60 AFTER FILTRATION: - Free 0.15 - Total 0.25
COMMENTS AND DESCRIPTION: Floc produced was medium, fluffy but fairly heavy and settled well.	pH 7.90 Alkalinity 95 Aluminum 0.03 mg/L Turbidity 0.26 FTU
JAR #: 09-P-3 Optimum PAC dosage with best polymer.	
TREATMENT: 1.0 mg/L Cl_2 + 20 mg/L alum + 0.5 mg/L Magnifloc 905N.	CHLORINE RESIDUAL: (mg/L) BEFORE COAGULATION: - Free 0.28 - Total 0.55 AFTER FILTRATION: - Free 0.10 - Total 0.30
COMMENTS AND DESCRIPTION: The floc produced was medium, fluffy and fairly heavy but a little sticky.	pH 7.70 Alkalinity 88 Aluminum 0.035 mg/L Turbidity 0.15 FTU
JAR #: 09-P-4 pH adjustment with optimum PAC dosage with best polymer	
TREATMENT: 20 mg/L H_2SO_4 + 1.0 mg/L Cl_2 + 12.5 mg/L PAC + 0.5 mg/L Percol LT25.	CHLORINE RESIDUAL: (mg/L) BEFORE COAGULATION: - Free 0.23 - Total 0.68 AFTER FILTRATION: - Free 0.12 - Total 0.35
COMMENTS AND DESCRIPTION: Floc produced was medium, feathery and loose but fairly heavy.	pH 7.15 Alkalinity 60 Aluminum <.01 mg/L Turbidity 0.16 FTU
JAR #: 07-P-5 Optimum PAC dosage with activated silica.	
TREATMENT: 1.0 mg/L Cl_2 + 10 mg/L PAC + 5.0 mg/L activated silica.	CHLORINE RESIDUAL: (mg/L) BEFORE COAGULATION: - Free 0.10 - Total 0.375 AFTER FILTRATION: - Free 0.10 - Total 0.25
COMMENTS AND DESCRIPTION: A large quantity of small, light, feathery floc that settled well was produced.	pH 7.75 Alkalinity 95 Aluminum <.05 mg/L Turbidity 0.09 FTU

APPENDIX 3

FLOW MEASUREMENTS AND ANALYTICAL RESULTS

APPENDIX 3 INDEX

1984 - 1986

RAW & TREATED YEARLY FLOW SUMMARY
INCLUDING DOAN'S HOLLOW

TABLE 1.0

NOTE:

1) There is a Table 1.0 - Raw and Treated Water Flows, for both the water plant and Doan's Hollow Infiltration Gallery.

2) The 1984 and 1986 daily raw water flows tabulated on Table 1.1 contain only the water plant flows.

3) The 1985 daily raw water flows contain both the water plant and Doan's Hollow flows.

4) The 1984 to 1986 daily treated water flows tabulated in Table 1.1 contain the water plant and Doan's Hollow flows.

5) It was evident after the flows were tabulated that the raw water flows were 14% to 69% greater than the treated water flows at the water plant. The possible factors contributing to this discrepency are outlined in Section B 8.2 of the report. We believe that the main factor contributing to the discrepency is the throttling of the valve on the discharge side of the old low lift header to reduce flow to the plant. Since the old low lift flows are based on pump run time, there is no method of measuring the actual flow when the discharge valve is partially closed.

TABLE 1.0: **FLOWS (ML/d) - Water Plant**

MOE WPOS PROTOCOL

PORT DOVER WATER TREATMENT PLANT

		1986			1985			1984			1983		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
JAN	R	5.53	3.81	4.57	3.51	1.85	2.43	4.36*	2.33*	3.34*			
	T	3.28	2.46	2.93	3.04	1.18	1.79	5.11	3.24	3.79			
FEB	R	5.06	3.54	4.40	4.66	1.77	2.66	4.39*	1.47*	3.13*			
	T	3.03	2.41	2.72	2.05	1.15	1.83	4.84	2.49	3.73			
MAR	R	6.16	3.68	4.64	4.57	1.47	3.32	2.31*	1.22*	1.82*			
	T	3.41	2.60	3.04	3.24	1.55	2.67	2.00	1.33	1.66			
APR	R	5.07	2.46	3.68	4.42	3.30	3.74	3.50	1.65	2.48			
	T	3.70	1.60	2.38	3.15	2.53	2.80	3.25	1.51	2.27			
MAY	R	5.80	2.54	4.05	4.94	3.49	4.03	3.42*	1.66*	2.20*			
	T	3.80	2.59	2.67	3.93	2.62	3.07	3.48	1.51	2.62			
JUN	R	5.76	2.46	4.02	4.94	3.73	4.17	5.49	3.16	3.83			
	T	3.60	2.01	2.48	3.96	2.80	3.11	3.96	2.27	3.35			
JUL	R	6.62	3.78	5.13	7.02	2.81	4.13	4.90	2.44	4.06			
	T	4.32	2.63	3.10	3.89	1.28	2.90	4.01	2.27	3.21			
AUG	R	5.02	3.08	3.68	6.98	3.78	4.53	5.42	3.09	3.72			
	T	2.90	1.86	2.27	5.39	2.59	3.16	4.11	2.15	2.75			
SEP	R	4.77	2.82	3.70	4.83	2.22	2.24	3.36	1.90	2.52			
	T	2.80	1.62	2.19	3.19	1.59	2.17	2.48	1.78	2.05			
OCT	R	5.29	2.38	3.48	4.94	3.74	4.37	3.48	1.70	2.76			
	T	3.22	1.36	2.02	3.39	2.49	3.00	3.12	1.58	2.24			
NOV	R	4.59	2.38	3.27	4.93	2.14	3.74	3.61	1.40	2.22			
	T	2.90	1.35	1.94	3.26	2.43	2.50	2.30	1.24	1.70			
DEC	R	4.47	2.09	3.12	4.47	3.49	4.00	3.52	2.08	2.38			
	T	2.62	1.28	1.91	3.23	2.17	2.70	2.57	1.42	1.61			

* INCOMPLETE DATA

TABLE 1.0: FLOWS (ML/d) - Doan's Hollow

MOE WPOS PROTOCOL

		1986			1985			1984			1983		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
JAN	R	*	*	*	1.09	0.00	0.89	1.09	0.00	0.29			
	T	*	*	*	1.09	0.00	0.89	1.09	0.00	0.29			
FEB	R	*	*	*	1.09	0.00	0.86	1.09	0.00	0.76			
	T	*	*	*	1.09	0.00	0.86	1.09	0.00	0.76			
MAR	R	*	*	*	1.09	0.00	0.86	1.09	1.09	1.09			
	T	*	*	*	1.09	0.00	0.86	1.09	1.09	1.09			
APR	R	1.35	0.00	0.63	0.00	0.00	0.00	1.09	0.00	0.75			
	T	1.35	0.00	0.63	0.00	0.00	0.00	1.09	0.00	0.75			
MAY	R	1.49	0.00	0.65	0.00	0.00	0.00	1.09	0.00	0.46			
	T	1.49	0.00	0.65	0.00	0.00	0.00	1.09	0.00	0.46			
JUN	R	1.43	0.00	0.48	0.00	0.00	0.00	1.09	0.00	0.06			
	T	1.43	0.00	0.48	0.00	0.00	0.00	1.09	0.00	0.06			
JUL	R	1.45	0.00	0.49	1.09	0.00	0.81	1.09	0.00	0.56			
	T	1.45	0.00	0.49	1.09	0.00	0.81	1.09	0.00	0.56			
AUG	R	1.43	1.22	1.35	1.09	0.00	0.76	1.09	0.00	0.93			
	T	1.43	1.22	1.35	1.09	0.00	0.76	1.09	0.00	0.93			
SEP	R	1.76	0.92	1.33	1.09	0.00	0.86	1.09	1.09	1.09			
	T	1.76	0.92	1.33	1.09	0.00	0.86	1.09	1.09	1.09			
OCT	R	1.44	0.00	1.08	0.00	0.00	0.00	1.09	0.00	0.64			
	T	1.44	0.00	1.08	0.00	0.00	0.00	1.09	0.00	0.64			
NOV	R	1.43	0.00	0.96	1.09	0.00	0.36	*	*	*			
	T	1.43	0.00	0.96	1.09	0.00	0.36	*	*	*			
DEC	R	1.57	0.00	0.71	1.09	0.00	0.04	1.09	0.00	1.02			
	T	1.57	0.00	0.71	1.09	0.00	0.04	1.09	0.00	1.02			

* Records not available

1984

RAW & TREATED DAILY FLOW SUMMARY
INCLUDING DOAN'S HOLLOW

TABLE 1.1

TABLE 1.1: DAILY FLOWS (ML/d) 1984 RAW WATER
MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MON										2.64		
TUE					1.71					2.01		
WED		2.95			1.90			3.24		1.97		
THU		3.08	1.96		1.87			3.91		2.01	2.33	
FRI		2.94	2.05		1.54	3.25		3.82		1.92	2.22	
SAT		3.49	1.22		1.81	3.21		3.48	3.10	1.85	1.86	2.16
SUN	4.29	3.84	1.83	2.01	2.17	3.33	4.38	3.86	3.01	1.70	2.28	2.43
MON	3.07	3.66	1.88	2.13	2.24	3.52	4.68	4.26	3.36	2.17	1.72	2.13
TUE	3.08	3.36	2.09	2.23	2.38	3.70	4.90	4.04	3.19	3.22	2.30	2.19
WED	3.24	3.05	2.14	2.21	2.17	3.47	4.59	5.42	2.98	3.18	2.03	2.47
THU	2.75	3.05	1.92	3.42	2.20	3.56	4.54	4.78	3.22	3.33	2.62	2.42
FRI	4.36	2.89	1.55	3.33	2.13	3.53	3.88	4.65	2.67	3.48	2.17	2.56
SAT	2.63	2.92	1.71	2.81	1.74	3.91	3.89	3.90	2.64	3.24	1.96	2.37
SUN	2.91	2.67	1.61	3.26	2.43	4.27	4.26	4.67	2.67	3.03	1.96	2.40
MON	4.10	3.79	1.85	3.36	3.42	4.03	4.40	4.50	2.45	3.07	1.95	2.40
TUE	3.96	4.10	1.54	3.43	3.07	3.23	4.51	3.29	2.28	2.94	1.96	2.27
WED	4.03	4.02	1.86	3.31	2.65	4.72	4.36	3.19	2.63	3.38	1.84	2.19
THU	3.60	2.59	1.47	2.70	2.24	3.94	4.64	3.69	2.26	3.32	1.40	2.20
FRI	3.49	3.97	1.46	2.03	1.72	2.82	4.77	3.64	2.17	3.95	1.86	2.24
SAT	3.74	4.03	1.55	1.61	2.34	2.92	4.72	2.91	2.11	3.37	1.83	2.08
SUN	3.43	4.31	2.08	1.99	1.66	2.88	4.64	3.29	2.65	4.07	1.97	2.25

TABLE 1.1: (Cont'd)

PORT DOVER WATER TREATMENT PLANT

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MON	3.44	4.25	2.31	2.24	1.92	4.10	3.85	3.74	2.52	2.29	2.50	2.51
TUE	3.71	4.39	1.89	2.28	1.89	4.10	3.46	3.59	2.23	2.40	2.39	2.30
WED	3.43	2.67	1.70	2.35	1.96	4.14	3.02	3.57	2.36	2.83	2.32	2.52
THU	3.49	2.27	1.69	2.24	1.88	4.48	3.26	3.16	2.31	2.03	2.96	2.21
FRI	3.53	1.94	1.68	1.65	1.75	4.07	3.19	3.15	2.26	2.98	2.49	2.29
SAT	3.72	1.76	2.07	1.74	1.89	4.53	2.44	3.30	2.61	2.55	2.17	3.36
SUN	3.58	2.07	2.08	1.66	2.14	4.99	3.25	3.47	2.36	3.39	2.33	3.52
MON	3.31	1.47	1.99	2.64	2.12	3.98	4.39	3.58	2.58	2.26	2.05	2.57
TUE	2.33	2.01	1.77	3.38	3.08	4.14	4.49	3.36	2.43	2.53	3.61	2.05
WED	2.43		1.97	3.50	3.13	3.16	3.11	3.26	2.34	2.44	2.34	2.35
THU	2.89		1.73	2.48	3.14	3.19	3.50	3.09	2.15		2.92	2.24
FRI	2.69		2.14	2.35		4.09	2.93	3.36	2.14		2.22	2.19
SAT	3.00		1.71	2.03		5.49	3.70		1.90			2.10
SUN	3.40			2.09			4.53		2.14			2.40
MON	2.92			2.00			4.95					2.42
TUE	2.95						4.78					
MAX	4.36	4.39	2.31	3.50	3.42	5.49	4.90	5.42	3.36	3.48	3.61	3.52
MIN	2.33	1.47	1.22	1.61	1.54	3.16	2.44	3.09	1.90	1.70	1.40	2.05
AVG	3.34	3.13	1.82	2.48	2.20	3.83	4.06	3.72	2.52	2.76	2.22	2.38

TABLE 1.1: DAILY FLOWS (ML/d) 1984 TREATED WATER INCLUDING DOAN'S HOLLOW
MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MON										3.12		
TUE					2.76					3.09		
WED		5.04			2.82			4.77		2.88		
THU		5.26	2.82		2.97			4.04		2.96	2.77	
FRI		5.03	3.01		2.61	3.25		4.07		2.91	2.77	
SAT		5.57	2.58		2.80	2.94		3.71	3.02	2.81	2.77	2.65
SUN	4.29	5.93	2.87	2.96	3.07	3.18	3.38	4.01	3.10	2.68	3.02	2.88
MON	4.03	5.75	2.68	2.97	3.16	3.35	3.70	4.26	3.57	3.17	2.62	2.64
TUE	5.11	5.45	2.96	2.92	3.39	3.50	3.89	4.52	3.42	3.16	2.61	2.68
WED	4.99	5.24	2.98	3.19	3.05	3.37	3.53	4.86	3.27	2.83	2.33	2.61
THU	3.82	5.06	2.96	3.25	3.02	3.39	3.55	3.62	3.22	3.12	2.91	2.87
FRI	4.50	5.08	2.37	3.03	3.06	3.37	3.02	3.44	3.00	2.67	2.52	2.67
SAT	3.03	5.01	2.62	2.54	2.69	3.83	2.99	2.91	3.20	2.94	2.71	2.60
SUN	3.70	4.77	2.61	3.14	3.39	3.96	3.20	3.54	3.46	2.77	2.52	2.68
MON	3.91	4.15	2.64	2.96	3.23	3.78	3.34	3.26	3.19	2.72	2.52	2.60
TUE	3.96	4.00	2.51	3.01	3.38	3.84	3.46	3.38	2.96	2.81	2.71	2.65
WED	3.93	3.83	2.54	2.99	3.47	3.70	3.41	3.57	3.12	2.85	2.97	2.57
THU	3.50	3.54	2.45	3.14	3.48	3.01	3.49	3.55	3.04	2.90	2.52	2.59
FRI	3.49	3.49	2.42	2.92	2.82	2.69	3.61	3.74	3.00	2.80	2.72	2.55
SAT	3.55	3.85	2.53	2.63	3.20	3.05	3.73	3.10	2.92	2.65	2.70	2.62
SUN	3.24	4.31	2.95	2.96	3.17	3.77	3.96	3.42	3.26	3.06	2.79	2.62

TABLE 1.1: (Cont'd)

PORT DOVER WATER TREATMENT PLANT

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MON	3.25	4.15	3.09	3.03	3.24	2.27	3.92	3.76	3.16	2.79	2.89	2.65
TUE	3.62	4.30	2.80	3.22	3.27	3.23	3.70	3.63	2.96	2.73	2.98	2.57
WED	3.43	4.67	2.56	3.25	3.06	3.19	3.36	3.51	3.09	2.97	2.85	2.51
THU	3.40	4.06	2.63	3.27	3.16	3.65	3.51	3.25	3.01	2.82	3.30	2.58
FRI	3.43	4.35	2.72	2.86	2.84	3.23	3.58	3.41	2.90	2.77	2.93	2.58
SAT	3.62	3.58	3.09	2.74	3.15	3.73	3.66	3.69	3.33	2.86	2.66	2.61
SUN	3.39	4.10	3.00	2.60	3.48	3.45	3.91	3.50	3.05	2.97	2.99	2.48
MON	3.85	3.95	2.94	3.52	2.85	3.40	4.42	3.78	3.14	2.75	2.81	2.72
TUE	4.28	3.86	2.71	3.05	2.89	3.04	4.54	3.60	3.38	2.81	2.86	2.55
WED	4.52	3.83	2.80	3.21	2.94	2.96	4.47	3.38	3.27	2.87	2.72	2.72
THU	4.97		2.64	3.23	3.02	3.12	3.69	4.48	3.02		3.39	2.64
FRI	4.77		3.09	3.29		3.20	3.32	3.49	3.14		2.80	2.62
SAT	5.09		2.67	2.90		3.90	3.98		2.87			2.61
SUN	5.58			3.00			4.53		3.10			2.71
MON	5.10			3.00			5.10					2.59
TUE	5.14						4.80					
MAX	5.58	5.93	3.09	3.52	3.48	3.96	4.54	4.86	3.57	3.17	3.39	2.88
MIN	3.03	3.49	3.23	2.54	2.61	2.27	2.99	2.91	2.90	2.65	2.33	2.48
AVG	4.08	4.56	2.75	3.02	3.07	3.35	3.77	3.72	3.24	2.88	2.79	2.63

1985

RAW & TREATED DAILY FLOW SUMMARY
INCLUDING DOAN'S HOLLOW

TABLE 1.1

TABLE 1.1: DAILY FLOWS (ML/d) 1985 - RAW WATER INCLUDING DOAN'S HOLLOW
MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MON				4.42			4.16					
TUE	3.23			3.97			4.61			4.73		
WED	3.15			3.97	3.90		4.91			4.52		
THU	3.37			3.71	3.91		4.96	6.52		4.55		
FRI	3.30	3.39	3.68	4.08	4.15		4.69	7.16		3.74	3.85	
SAT	3.35	3.33	3.31	3.67	3.72	3.81	4.64	7.15	3.99	3.84	3.84	
SUN	3.51	3.32	3.64	3.75	3.73	4.01	4.26	7.00	3.80	4.53	4.48	3.51
MON	3.16	3.27	3.35	4.23	3.91	4.41	4.77	6.74	4.57	4.20	4.17	3.83
TUE	3.39	3.33	3.97	3.62	3.71	4.13	4.50	6.89	4.41	4.48	3.85	4.35
WED	3.36	3.50	3.72	3.30	3.93	4.31	4.30	5.03	4.07	4.61	4.05	4.43
THU	3.33	3.24	4.41	3.52	4.25	4.52	4.42	5.76	4.15	4.38	4.21	4.34
FRI	3.34	3.37	4.57	3.50	3.85	4.94	3.90	6.28	3.81	3.95	3.71	4.08
SAT	3.04	3.53	3.14	3.60	4.31	3.73	4.48	7.12	4.41	3.97	3.79	3.71
SUN	3.52	3.46	4.26	3.86	4.59	3.73	4.06	6.47	4.33	3.86	4.18	4.24
MON	3.21	3.34	3.51	4.10	4.29	4.92	4.04	6.98	4.83	4.52	4.02	4.35
TUE	3.36	3.22	3.38	3.72	4.64	4.08	4.01	6.54	3.99	4.66	4.31	4.26
WED	3.17	3.15	3.59	3.62	4.19	3.76	3.92	5.55	4.53	4.70	4.47	4.14
THU	2.95	3.31	4.03	3.41	4.08	4.36	4.80	4.44	3.71	4.56	4.89	4.23
FRI	3.23	2.86	3.78	3.57	3.81	3.91	4.83	3.99	3.86	3.95	4.22	3.86
SAT	3.17	3.41	4.12	3.77	3.74	3.85	4.47	4.22	3.86	4.27	3.81	3.94
SUN	2.94	3.64	4.29	3.81	3.49	3.64	4.52	4.23	4.21	4.71	2.46	4.19

TABLE 1.1: (Cont'd)

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MON	3.52	3.21	3.62	3.74	4.20	3.93	4.69	4.83	4.28	4.33	4.93	3.86
TUE	3.27	3.97	2.92	3.65	4.20	3.89	5.37	4.49	4.16	4.66	4.67	3.49
WED	3.38	3.49	2.87	3.61	4.06	4.07	5.57	4.14	4.23	4.60	3.90	3.80
THU	3.67	3.49	2.75	3.74	3.99	3.85	6.04	4.49	4.38	4.69	4.33	4.24
FRI	3.16	3.44	2.92	3.78	4.11	4.08	5.67	4.46	3.84	4.94	3.55	3.79
SAT	3.65	3.89	2.69	3.35	4.20	3.74	6.23	3.72	3.82	4.13	3.76	4.05
SUN	3.38	4.59	2.81	3.76	4.01	4.12	6.60	4.27	4.40	4.29	4.11	3.62
MON	3.80	4.66	2.73	3.78	3.91	4.20	8.11	4.27	4.46	4.37	4.36	4.47
TUE	3.60	3.79	2.64	3.63	3.83	4.50	6.48	4.62	4.15	4.39	4.28	4.16
WED	3.27	3.39	2.56		4.18	4.55	4.99	4.31	4.33	4.31	4.04	4.08
THU	3.46	4.16	3.79		4.11	4.70		4.00	4.36	4.02	3.68	3.58
FRI			3.59		3.96	4.75		4.38	4.08		3.23	4.00
SAT			3.84			4.27		3.78	4.68		4.10	3.96
SUN			4.03			4.37			4.58			4.30
MON									4.29			4.17
TUE												4.03
MAX	3.80	4.66	4.57	4.42	4.64	4.94	8.11	7.16	4.83	4.94	4.93	4.47
MIN	2.94	2.86	2.56	3.30	3.49	3.73	3.90	3.78	3.71	3.74	2.46	3.49
AVG	3.33	3.53	3.50	3.74	4.03	4.17	4.94	5.28	4.22	4.37	4.04	4.05

TABLE 1.1: DAILY FLOWS (ML/d) 1985 – TREATED WATER
MOE WPOS PROTOCOL

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MON				2.73			3.09					
TUE	2.64			2.89			3.40			3.24		
WED	2.56			2.92	3.06		3.84			3.11		
THU	2.61			2.75	2.78		3.89	4.78		3.18		
FRI	3.04	2.61	2.62	2.97	3.01		3.42	5.39		2.55	2.70	
SAT	2.69	2.75	2.57	2.70	2.62	2.88	3.18	5.31		2.93	2.64	
SUN	2.57	2.71	2.90	2.71	2.68	3.07	2.80	5.16	2.90	3.11	3.05	2.61
MON	2.50	2.67	2.59	3.15	2.98	3.24	3.15	4.93	3.27	3.04	2.97	2.81
TUE	2.70	2.65	2.52	2.82	2.77	3.18	3.34	4.95	3.45	3.03	2.43	3.01
WED	2.79	2.75	2.75	2.60	2.92	3.19	3.19	3.57	3.16	3.39	2.73	3.06
THU	2.61	2.61	3.22	2.84	2.89	3.41	3.37	3.84	3.09	3.01	2.88	3.23
FRI	2.67	2.59	3.24	2.82	2.79	3.96	2.95	4.06	3.00	2.96	2.49	2.56
SAT	2.59	2.73	2.38	2.86	3.15	2.99	3.44	5.08	3.28	2.76	2.59	2.60
SUN	2.75	2.67	2.96	3.03	3.46	2.83	3.00	4.20	2.93	2.69	2.89	2.95
MON	2.76	2.60	2.74	2.93	3.16	3.23	3.21	5.00	3.19	3.20	2.80	3.02
TUE	2.27	2.44	2.83	2.62	3.13	2.93	3.12	5.13	2.90	3.18	2.87	2.87
WED	2.76	2.47	2.53	2.60	3.07	2.92	3.08	4.27	3.12	3.05	3.05	2.83
THU	2.59	2.61	3.12	2.65	3.15	3.19	3.50	3.43	2.94	3.19	3.17	2.85
FRI	2.62	2.24	2.92	2.55	3.02	2.97	2.37	2.59	2.90	2.49	2.60	2.61
SAT	2.67	2.95	3.03	2.59	2.99	3.05	3.24	3.35	2.99	2.99	2.54	2.64
SUN	2.87	2.72	3.12	2.87	2.81	2.93	3.22	3.42	3.15	3.39	3.26	2.74

TABLE 1.1 (cont'd)

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MON	2.74	3.14	3.15	2.84	3.25	2.96	3.39	3.43	3.26	2.93	3.07	2.68
TUE	2.68	2.97	3.09	2.79	3.07	2.93	3.68	3.55	3.21	3.09	2.98	2.38
WED	2.66	2.82	3.07	2.78	3.24	2.85	4.08	3.20	3.19	3.12	2.66	2.56
THU	2.46	2.79	3.07	2.83	3.93	2.93	4.26	3.43	3.19	3.15	3.01	2.78
FRI	2.65	2.78	3.07	2.83	3.25	2.85	4.00	3.39	3.04	3.08	2.90	2.77
SAT	2.94	2.69	2.96	2.53	3.37	2.80	4.54	2.88	3.00	2.69	2.75	2.75
SUN	2.77	2.75	2.94	2.84	3.20	3.13	4.54	3.18	3.46	2.69	3.01	2.44
MON	2.97	2.57	2.86	2.98	3.03	3.12	4.97	3.26	3.33	2.98	3.14	2.93
TUE	2.81	2.71	2.99	3.00	2.91	3.29	4.45	3.40	2.99	3.09	3.21	2.69
WED	2.71	2.49	2.66		3.34	3.17	3.48	3.20	3.16	2.91	2.97	2.74
THU	2.70	2.75	2.96		3.12	3.46		3.25	3.09	2.78	2.74	2.17
FRI			2.64		2.96	3.44		3.42	3.09		2.55	2.64
SAT			2.80			3.20		2.88	2.80		3.04	2.57
SUN			3.11			3.27			3.03			2.87
MON												3.18
TUE												2.76
MAX	3.04	3.14	3.24	3.15	3.93	3.96	4.97	5.39	3.46	3.39	3.26	3.18
MIN	2.27	2.24	2.38	2.53	2.62	2.80	2.37	2.59	2.80	2.49	2.43	2.17
AVG	2.69	2.69	2.88	2.80	3.07	3.11	3.52	3.92	3.10	3.00	2.86	2.75

1986

RAW & TREATED DAILY FLOW SUMMARY INCLUDING DOAN'S HOLLOW

TABLE 1.1

TABLE 1.1: DAILY FLOWS (ML/d) 1986 TREATED WATER INCLUDING DOAN'S HOLLOW
MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MON									4.15			2.62
TUE				3.25			3.00		4.11			2.42
WED	2.46			3.47			3.08		4.04	3.52		2.09
THU	3.01			3.30	3.10		3.83	3.26	3.85	3.49		2.55
FRI	3.18			2.75	2.90		3.70	3.08	3.69	3.02		2.41
SAT	2.70	2.62	2.68	3.01	2.67		4.21	3.36	3.66	2.75	3.05	2.41
SUN	3.02	2.55	3.10	3.16	3.14	3.01	4.91	3.53	4.13	3.22	3.15	2.52
MON	3.05	2.85	3.24	3.49	3.17	4.91	3.79	4.16	3.08	3.20	2.59	
TUE	2.97	2.79	2.99	3.12	3.33	3.50	3.79	3.79	3.96	3.03	3.24	2.70
WED	3.05	2.70	3.15	3.16	3.13	3.33	3.79	3.50	3.94	3.01	2.89	2.69
THU	2.76	2.74	3.14	3.31	3.30	3.08	4.61	3.71	3.45	3.31	3.00	2.78
FRI	2.74	2.59	2.75	3.48	3.25	3.08	3.20	3.31	3.37	3.04	2.96	2.65
SAT	2.58	2.75	2.64	2.90	3.48	2.88	3.01	3.36	2.79	3.04	2.87	2.68
SUN	2.68	2.85	2.98	3.19	3.73	3.32	2.63	3.72	3.93	2.64	3.03	2.95
MON	3.07	2.96	3.05	3.47	3.71	3.70	2.97	3.44	3.49	3.32	2.95	2.90
TUE	3.19	2.97	3.15	3.08	3.80	3.38	3.06	3.51	3.23	3.19	3.01	2.67
WED	2.85	2.94	3.24	3.35	3.13	2.72	3.15	3.69	3.40	2.98	3.10	2.66
THU	2.50	2.65	3.16	2.84	3.20	2.75	3.34	3.75	3.26	3.13	2.80	2.82
FRI	3.15	2.42	3.23	2.57	3.06	2.34	3.30	3.41	2.89	3.07	2.55	2.44
SAT	2.64	2.63	2.89	2.64	3.41	3.23	3.17	3.98	3.03	2.73	2.47	3.14
SUN	3.28	2.67	3.07	2.74	3.43	2.60	3.31	3.99	3.53	2.80	2.57	2.84

TABLE 1.1: (Cont'd)

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MON	5.12	4.44	5.18	3.70	2.74	4.10	5.67	5.02	3.44	3.43	3.21	2.67
TUE	5.12	4.37	4.40	3.78	4.25	4.38	5.77	4.29	3.23	3.36	2.96	2.75
WED	5.02	4.31	4.68	4.73	4.33	4.68	6.07	4.76	3.39	3.31	2.60	2.18
THU	4.66	4.20	4.85	4.70	2.76	4.31	6.44	4.04	3.46	3.44	2.58	3.67
FRI	4.50	3.99	4.24	4.38	2.60	4.83	6.13	4.62	2.65	2.95	2.95	4.10
SAT	5.06	4.40	4.03	4.20	2.88	4.27	5.48	3.28	3.56	2.90	2.38	3.67
SUN	5.14	5.06	4.93	4.25	2.63	4.97	4.78	3.63	3.52	3.24	2.61	4.47
MON	4.96	4.73	4.75	5.02	2.87	4.93	7.93	3.89	3.66	3.50	3.29	4.22
TUE	4.63	4.87	4.60	4.19	2.82	4.60	6.62	3.83	3.50	2.68	2.86	4.22
WED	4.05	3.54	4.70	5.07	2.54	4.68	4.55	3.60		3.14	3.87	4.19
THU	4.14	4.48	4.76		2.89	4.95	4.53	3.89		3.23	4.59	
FRI		4.58	4.06		3.59	4.27		3.44		2.40	4.58	
SAT			4.18		3.08	5.63		3.46			4.22	
SUN			4.23			4.54		3.71			4.09	
MON			4.55			5.76						
TUE												
MAX	5.53	5.06	6.16	5.07	5.80	5.76	7.93	5.02	4.77	5.29	4.59	4.47
MIN	3.81	3.54	3.68	2.46	2.54	2.46	3.78	3.08	2.82	2.38	2.38	2.09
AVG	4.57	4.40	4.64	3.68	4.05	4.02	5.13	3.68	3.70	3.48	3.27	3.12

TABLE 1.1: DAILY FLOWS (ML/d) 1986 RAW WATER

MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MON									4.77			4.15
TUE				4.69			4.55		4.46			3.75
WED	3.93			3.72			4.79		4.63	3.40		4.07
THU	5.53			3.18	4.95		4.31		4.41	3.89		3.72
FRI	4.21			2.46	5.04		3.78	3.18	4.41	4.44		3.67
SAT	3.90	4.02	4.41	2.85	4.20		4.57	3.09	4.00	4.63	2.95	3.60
SUN	4.41	3.88	5.11	3.20	4.76	2.46	5.43	3.24	4.60	5.14	3.17	3.94
MON	4.54	4.56	5.07	2.82	5.51	2.84	5.62	3.08	4.83	5.29	3.13	2.46
TUE	4.40	4.30	4.19	2.94	5.06	3.24	4.37	3.77	4.51	5.19	3.29	2.28
WED	4.58	4.29	4.66	2.93	5.12	3.19	4.39	3.80	3.46	4.99	2.78	2.05
THU	4.05	4.32	4.47	3.18	5.31	2.85	5.34	3.16	3.40	3.84	2.92	2.40
FRI	4.19	3.93	3.99	3.46	4.95	2.67	3.50	3.52	3.35	3.03	2.84	2.09
SAT	3.81	4.16	3.68	2.55	5.43	2.55	3.55	2.97	2.82	2.86	2.62	2.47
SUN	4.15	4.45	4.40	2.90	5.76	3.00	4.41	3.10	3.77	2.38	2.94	2.65
MON	4.61	4.70	4.56	3.59	5.80	3.69	5.08	3.54	3.63	3.26	2.91	2.57
TUE	4.66	4.76	6.16	2.84	5.60	3.10	5.19	3.11	3.44	3.11	2.71	2.39
WED	4.31	4.97	4.80	2.93	4.98	2.95	5.25	3.46	3.43	3.01	3.05	2.40
THU	4.81	4.25	5.08	4.41	3.84	4.25	5.24	3.84	3.28	3.04	3.51	2.44
FRI	4.37	4.04	4.93	3.96	2.78	3.66	5.30	4.13	2.89	3.46	4.28	2.17
SAT	5.01	4.29	4.69	3.87	3.30	5.15	5.07	3.49	2.96	2.55	4.14	2.63
SUN	5.45	4.35	4.61	4.02	3.13	4.03	5.26	4.10	3.60	2.70	4.27	2.57

TABLE 1.1: (Cont'd)

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MON	3.20	2.59	3.41	2.79	3.02	2.79	3.30	3.90	3.39	3.39	2.88	2.91
TUE	3.09	2.48	3.04	2.68	2.86	2.53	3.81	4.20	3.36	3.16	2.97	2.79
WED	2.94	2.41	3.07	3.70	2.59	2.73	4.03	3.86	3.14	3.29	2.71	2.79
THU	3.07	2.55	3.15	2.86	2.97	2.68	4.32	4.05	3.38	3.25	2.75	2.43
FRI	2.78	2.44	2.94	2.43	2.99	2.74	3.96	3.42	2.56	3.05	3.09	2.58
SAT	2.80	2.62	2.60	2.83	3.43	3.28	3.67	3.58	3.91	2.94	2.95	2.35
SUN	3.13	3.03	3.23	2.73	3.05	2.96	3.18	3.59	3.20	3.40	2.63	2.58
MON	3.22	2.93	3.23	3.07	3.16	2.65	3.69	3.76	3.40	3.38	3.01	2.59
TUE	3.16	3.03	3.19	2.80	3.18	2.63	3.27	3.39	3.37	3.15	3.19	2.56
WED	3.06	2.84	3.12	3.06	2.93	2.65	3.89	3.67		3.07	2.84	2.44
THU	2.75	2.68	3.07		3.45	2.82	3.42	3.28		3.10	2.82	
FRI	2.82	2.92	2.78		3.72	2.54		3.39		2.67	2.90	
SAT			2.87		3.26	3.37		3.60			2.75	
SUN			3.05			2.67					2.68	
MON			3.15			3.60						
TUE												
MAX	3.28	3.03	3.41	3.70	3.80	3.60	4.91	4.20	4.16	3.52	3.24	3.14
MIN	2.46	2.41	2.60	2.43	2.59	2.34	2.63	3.08	2.56	2.64	2.47	2.09
AVG	2.93	2.72	3.04	3.00	3.32	2.96	3.59	3.61	3.52	3.10	2.90	2.63

1984 - 1986

PARTICULATE REMOVAL SUMMARY

TABLE 2.0

NOTE:

1) The results in Tables 2.0 and 2.1 are based on in-plant tests performed by operations staff.

TABLE 2.0: PARTICULATE REMOVAL SUMMARY

MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

				1986			1985			1984			1983		
				Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
JAN	Turbidity (FTU)		R	NA	NA	NA	5.30	0.24	1.71	2.60	0.42	0.77			
			T	NA	NA	NA	0.44	0.10	0.20	0.54	0.17	0.26			
	Prime Coagulant	(mg/L)		16.90	3.00	9.40	18.50	4.50	10.20	NA	NA	NA			
	Coagulant Aid	(mg/L)													
	Filter Aid	(mg/L)													
	Metal Res. Al/Fe	(mg/L)	R												
			T												
	pH		R												
			T												
	Temperature	(°C)		1	0	0.26	5	0	1.30	3	1	2.4			
FEB	Turbidity (FTU)		R	NA	NA	NA	14.0	0.18	1.90	10.0	0.24	1.21			
			T	NA	NA	NA	0.75	0.05	0.20	3.40	0.12	0.35			
	Prime Coagulant	(mg/L)		10.00	4.50	7.90	61.50	8.80	14.00	NA	NA	NA			
	Coagulant Aid	(mg/L)													
	Filter Aid	(mg/L)													
	Metal Res. Al/Fe	(mg/L)	R												
			T												
	pH		R												
			T												
	Temperature	(°C)		1	0	0.39	2	0	1.18	3	2	2.9			
MAR	Turbidity (FTU)		R	NA	NA	NA	0.65	0.50	0.58	1.20	0.44	0.72			
			T	NA	NA	NA	0.26	0.16	0.23	0.43	0.19	0.27			
	Prime Coagulant	(mg/L)		22.70	1.60	6.40	37.30	7.90	14.30	NA	NA	NA			
	Coagulant Aid	(mg/L)													
	Filter Aid	(mg/L)													
	Metal Res. Al/Fe	(mg/L)	R												
			T												
	pH		R												
			T												
	Temperature	(°C)		7	0	1.97	7	0	2.42	3	2	2.3			

TABLE 2.0: PARTICULATE REMOVAL SUMMARY (cont'd)

MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

				1986			1985			1984			1983		
				Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
APR	Turbidity (FTU)		R	NA	NA	NA	NA	NA	NA	3.60	0.52	1.21			
			T	NA	NA	NA	NA	NA	NA	0.70	0.12	0.29			
	Prime Coagulant	(mg/L)		6.50	1.10	3.50	27.90	3.20	10.10	NA	NA	NA			
	Coagulant Aid	(mg/L)													
	Filter Aid	(mg/L)													
	Metal Res. Al/Fe	(mg/L)	R												
			T												
	pH		R												
			T												
	Temperature	(^oC)		12	5	8.17	10	3	6.23	9	3	6.4			
MAY	Turbidity (FTU)		R	NA	NA	NA	NA	NA	NA	1.74	0.52	1.05			
			T	NA	NA	NA	NA	NA	NA	0.86	0.18	0.40			
	Prime Coagulant	(mg/L)		5.10	0.80	2.40	16.30	3.90	6.00	NA	NA	NA			
	Coagulant Aid	(mg/L)													
	Filter Aid	(mg/L)													
	Metal Res. Al/Fe	(mg/L)	R												
			T												
	pH		R												
			T												
	Temperature	(^oC)		16	8	11.00	14	10	11.13	12	9	9.87			
JUN	Turbidity (FTU)		R	NA	NA	NA	NA	NA	NA	1.50	0.40	0.66			
			T	NA	NA	NA	NA	NA	NA	0.52	0.22	0.33			
	Prime Coagulant	(mg/L)		6.40	1.80	4.60	22.60	3.20	7.70	NA	NA	8.02			
	Coagulant Aid	(mg/L)													
	Filter Aid	(mg/L)													
	Metal Res. Al/Fe	(mg/L)	R												
			T												
	pH		R												
			T												
	Temperature	(^oC)		16	9	12.37	17	10	13.93	20	10	13.87			

TABLE 2.0: PARTICULATE REMOVAL SUMMARY (cont'd)

MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

				1986			1985			1984			1983		
				Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
JUL	Turbidity	(FTU)	R	NA	NA	NA	NA	NA	NA	6.40	0.24	0.71			
			T	NA	NA	NA	NA	NA	NA	0.72	0.18	0.29			
	Prime Coagulant	(mg/L)		5.00	2.70	3.90	17.40	3.30	5.70	NA	NA	7.20			
	Coagulant Aid	(mg/L)													
	Filter Aid	(mg/L)													
	Metal Res. Al/Fe	(mg/L)	R												
			T												
	pH		R												
			T												
	Temperature	(°C)		24	13	19.03	22	16	19.35	22	22	17.9			
AUG	Turbidity	(FTU)	R	NA	NA	NA	NA	NA	NA	1.40	0.30	0.61			
			T	NA	NA	NA	NA	NA	NA	0.40	0.10	0.25			
	Prime Coagulant	(mg/L)		9.30	2.80	6.10	16.40	3.40	6.00	NA	NA	9.8			
	Coagulant Aid	(mg/L)													
	Filter Aid	(mg/L)													
	Metal Res. Al/Fe	(mg/L)	R												
			T												
	pH		R												
			T												
	Temperature	(°C)		25	18	21.97	24	21	22.32	23	22	22.4			
SEP	Turbidity	(FTU)	R	NA	NA	NA	NA	NA	NA	30.10	0.30	1.60			
			T	NA	NA	NA	NA	NA	NA	0.62	0.08	0.24			
	Prime Coagulant	(mg/L)		13.10	3.10	6.20	16.30	5.50	8.80	NA	NA	9.3			
	Coagulant Aid	(mg/L)													
	Filter Aid	(mg/L)													
	Metal Res. Al/Fe	(mg/L)	R												
			T												
	pH		R												
			T												
	Temperature	(°C)		21	17	18.70	23	18	21.20	22	16	19.30			

TABLE 2.0: PARTICULATE REMOVAL SUMMARY (cont'd)

MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

				1986			1985			1984			1983		
				Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
OCT	Turbidity (FTU)		R	NA	NA	NA	NA	NA	NA	0.90	0.22	0.49			
			T	NA	NA	NA	NA	NA	NA	0.30	0.16	0.24			
	Prime Coagulant	(mg/L)		13.60	5.30	8.50	27.90	5.20	11.10	NA	NA	9.6			
	Coagulant Aid	(mg/L)													
	Filter Aid	(mg/L)													
	Metal Res. Al/Fe	(mg/L)	R												
			T												
	pH		R												
			T												
	Temperature	(°C)		18	12	14.23	19	10	13.94	16	13	15.4			
NOV	Turbidity (FTU)		R	NA	NA	NA	NA	NA	NA	1.30	0.28	0.45			
			T	NA	NA	NA	NA	NA	NA	0.20	0.14	0.17			
	Prime Coagulant	(mg/L)		13.30	4.70	7.40	33.10	7.40	14.80	NA	NA	9.4			
	Coagulant Aid	(mg/L)													
	Filter Aid	(mg/L)													
	Metal Res. Al/Fe	(mg/L)	R												
			T												
	pH		R												
			T												
	Temperature	(°C)		12	5	7.90	12	6	9.30	14	5	8.8			
DEC	Turbidity (FTU)		R	NA	NA	NA	NA	NA	NA	8.00	0.28	1.31			
			T	NA	NA	NA	NA	NA	NA	0.30	0.10	0.17			
	Prime Coagulant	(mg/L)		10.80	4.50	7.30	23.10	5.70	11.10	NA	NA	8.7			
	Coagulant Aid	(mg/L)													
	Filter Aid	(mg/L)													
	Metal Res. Al/Fe	(mg/L)	R												
			T												
	pH		R												
			T												
	Temperature	(°C)		4	2	2.52	6	0	2.45	6	2	4.0			

1984

PARTICULATE REMOVAL PROFILE
(JANUARY, MAY, JULY, OCTOBER)

TABLE 2.1

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JAN./1984)

MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP. (^{o}C)
	Raw	Set *	Filter*	Treat.	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	
1	0.86			0.20								3
2	0.58			0.24								3
3	0.86			0.15								3
4	0.76			0.15								3
5	2.60			0.18								3
6	2.10			0.26								3
7	2.60			0.28								3
8	0.64			0.23								3
9	0.58			0.22								3
10	0.78			0.26								2
11	0.58			0.38								2
12	0.54			0.30								2
13	0.58			0.36								1
14	0.68			0.54								2
15	0.54			0.22								1

* - Not recorded (Equipment not available)

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JAN./1984) (cont'd) PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP. (^oC)
	Raw	Set *	Filter*	Treat.	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	
16	0.48			0.27								2
17	0.60			0.34								2
18	0.68			0.31								2
19	0.55			0.23								2
20	0.52			0.22								2
21	0.72			0.24								2
22	0.49			0.40								2
23	0.58			0.34								2
24	0.48			0.24								2
25	0.48			0.24								3
26	0.52			0.22								2
27	0.42			0.22								2
28	0.54			0.18								3
29	0.52			0.22								3
30	0.60			0.17								3
31	0.51			0.18								3

740 Kg of PAC was used during the month of January. Average monthly dosage cannot be calculated because of incomplete record of monthly flows for low lift plant #1.°

TABLE 2.1: PARTICULATE REMOVAL PROFILE (MAY/1984)

MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw**	Set *	Filter*	Treat.	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	(^{o}C)
1				0.20								10
2				0.32								10
3				0.20								10
4				0.18								10
5				0.19								9
6				0.19								9
7				0.18								9
8				0.23								10
9				0.31								10
10				0.23								10
11				0.26								10
12				0.20								10
13				0.18								10
14				0.86								10
15				0.38								10

* - Not recorded (Equipment not available)
** - Results not available (Recorder out of service)

TABLE 2.1: **PARTICULATE REMOVAL PROFILE (MAY/1984) (cont'd)** PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw	Set *	Filter*	Treat.	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	(^{o}C)
16	**			0.44								10
17	0.84			0.61								10
18	1.74			0.74								10
19	1.56			0.82								11
20	1.30			0.72								11
21	1.20			0.80								11
22	0.52			0.56								12
23	1.20			0.42								10
24	0.64			0.46								10
25	0.58			0.22								10
26	0.68			0.46								10
27	0.64			0.32								11
28	0.62			0.50								12
29	2.10			0.32								11
30	**			0.24								10
31	**			0.24								10

There is no record of the amount of PAC used during the month of May.

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JULY/1984)

MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw	Set *	Filter*	Treat.	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	(^{o}C)
1	0.56			0.30								19
2	0.60			0.26								19
3	0.62			0.30								17
4	0.44			0.22								18
5	0.46			0.22								18
6	0.60			0.30								19
7	0.70			0.24								17
8	0.62			0.23								12
9	0.62			0.36								13
10	0.48			0.40								15
11	0.60			0.42								16
12	0.52			0.36								14
13	0.68			0.42								16
14	0.62			0.30								16
15	0.40			0.28								17

* - Not recorded (Equipment not available)

TABLE 2.1: **PARTICULATE REMOVAL PROFILE (JULY/1984) (cont'd)** PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP. (^{o}C)
	Raw	Set *	Filter*	Treat.	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	
16	0.40			0.30								17
17	0.39			0.32								17
18	0.38			0.26								18
19	0.71			0.28								17
20	0.34			0.29								17
21	0.47			0.38								18
22	6.40			0.72								18
23	0.78			0.28								20
24	0.64			0.22								20
25	0.54			0.18								18
26	0.48			0.22								21
27	0.58			0.24								21
28	0.42			0.22								21
29	0.32			0.22								22
30	0.24			0.18								22
31	0.46			0.22								22

Avg. Concentration = Total monthly caogulant/total monthly flow
= 920 Kg/128.4 x 10^{6} litres
= 7.2 mg/l

TABLE 2.1: PARTICULATE REMOVAL PROFILE (OCT./1984)

MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw	Set *	Filter*	Treat.	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	(^oC)
1	0.30			0.24								16
2	0.42			0.20								16
3	0.90			0.25								16
4	0.82			0.25								15
5	0.72			0.24								15
6	0.56			0.18								15
7	0.58			0.20								13
8	0.42			0.28								14
9	0.58			0.30								15
10	0.42			0.30								16
11	0.52			0.26								16
12	0.45			0.24								16
13	0.36			0.26								16
14	0.34			0.28								16
15	0.22			0.25								16

* - Not recorded (Equipment not available)
** - Results not available (Recorder out of service)

TABLE 2.1: PARTICULATE REMOVAL PROFILE (OCT./1984) (cont'd) PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP. (^{o}C)
	Raw	Set *	Filter*	Treat.	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	
16	0.22			0.16								16
17	**			**								16
18	**			**								16
19	**			**								16
20	**			**								16
21	**			**								16
22	**			**								16
23	**			**								16
24	**			**								15
25	**			**								14
26	**			**								14
27	**			**								15
28	**			**								15
29	**			**								16
30	**			**								14
31	**			**								14

Avg. Concentration = Total monthly coagulant/total monthly flow
= 820 Kg/85.60 x 10^6 litres
= 9.58 mg/1

1985

PARTICULATE REMOVAL PROFILE
(JANUARY, MAY, JULY, OCTOBER)

TABLE 2.1

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JANUARY 1985)

MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw**	Set *	Filter*	Treat.**	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	(^{o}C)
1	1.20			0.10	**							5
2	5.20			0.18	**							3
3	5.00			0.17	11.00							3
4	0.90			0.33	13.20							3
5	0.92			0.44	11.10							3
6	5.30			0.22	10.60							3
7	2.00			0.18	8.60							3
8	0.80			0.20	11.00							2
9	1.20			0.20	11.20							2
10	1.20			0.12	9.10							2
11	1.40			0.26	10.40							0
12	0.56			0.20	14.10							0
13	1.20			0.14	12.20							0
14	2.20			0.18	8.90							0
15	1.80			0.24	9.00							0

* - Not recorded (Equipment not available) ** - Resulta not available (recorder out of service)

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JANUARY 1985) (cont'd) PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw **	Set *	Filter*	Treat.**	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	(°C)
16	2.00			0.32	11.30							0
17	3.40			0.18	12.50							0
18	0.28			0.14	10.80							0
19	**			**	8.60							0
20	**			**	9.80							0
21	**			**	6.30							1
22	**			**	9.40							2
23	**			**	9.70							1
24	0.28			0.12	11.40							2
25	**			**	10.10							1
26	**			**	10.40							1
27	**			**	9.70							1
28	0.30			0.22	18.50							1
29	0.26			0.20	8.40							0
30	**			0.20	4.50							0
31	0.24			0.14	5.10							1

TABLE 2.1: PARTICULATE REMOVAL PROFILE (MAY 1985)

MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw**	Set *	Filter*	Treat.**	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	(°C)
1					5.60							10
2					5.90							10
3					6.10							10
4					6.10							10
5					11.70							10
6					11.00							11
7					11.20							11
8					6.90							10
9					7.70							11
10					5.20							11
11					4.10							10
12					5.20							10
13					4.30							11
14					3.90							10
15					3.90							12

* - Not recorded (Equipment not available)

** - Results not available (recorder out of service)

TABLE 2.1: **PARTICULATE REMOVAL PROFILE (MAY 1985) (cont'd)** PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw **	Set *	Filter*	Treat.**	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	(^oC)
16					5.10							12
17					4.00							11
18					4.30							11
19					3.90							11
20					4.30							13
21					4.30							12
22					4.60							10
23					4.70							10
24					5.00							10
25					4.80							12
26					4.70							12
27					4.50							14
28					5.10							13
29					4.10							12
30					6.30							12
31					16.30							13

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JULY/1985)

MOE WPOS PROTOCOL

PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw**	Set *	Filter*	Treat.**	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	(°C)
1					4.50							18
2					4.30							18
3					4.40							18
4					4.30							18
5					7.70							19
6					17.40							20
7					7.30							19
8					6.90							19
9					8.70							20
10					9.90							17
11					3.00							16
12					4.00							17
13					4.00							18
14					5.30							20
15					5.00							20

* - Not recorded (Equipment not available)   ** - Results not available (recorder out of service)

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JULY/1985) (cont'd)

PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw **	Set *	Filter*	Treat.**	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	(°C)
16					3.90							19
17					3.90							18
18					3.50							18
19					6.50							21
20					3.60							20
21					5.60							20
22					7.90							20
23					7.60							18
24					6.70							20
25					8.20							20
26					5.50							21
27					3.30							21
28					2.90							20
29					3.40							21
30					3.50							22
31					3.40							22

TABLE 2.1: PARTICULATE REMOVAL PROFILE (OCT./1985)

MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw**	Set *	Filter*	Treat.**	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	(°C)
1					8.10							19
2					8.30							18
3					8.00							16
4					7.90							17
5					8.20							17
6					7.90							16
7					9.20							10
8					28.50							10
9					27.90							10
10					15.90							10
11					5.20							12
12					9.20							12
13					8.80							12
14					3.50							13
15					7.50							14

* - Not recorded (Equipment not available) ** - Results not available (recorder out of service)

TABLE 2.1: PARTICULATE REMOVAL PROFILE (OCT./1985) (cont'd) PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP. (^{o}C)
	Raw **	Set *	Filter*	Treat.**	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	
16					6.80							12
17					7.00							12
18					11.60							13
19					11.40							14
20					6.90							14
21					17.80							13
22					19.70							13
23					7.80							14
24					14.80							15
25					15.20							15
26					17.00							14
27					15.10							14
28					6.50							13
29					6.40							13
30					7.40							12
31					9.80							11

1986

PARTICULATE REMOVAL PROFILE
(JANUARY, MAY, JULY, OCTOBER)

TABLE 2.1

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JANUARY 1986)

MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw**	Set *	Filter*	Treat.**	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	(^{o}C)
1					6.70							0
2					4.90							0
3					11.80							0
4					6.00							0
5					10.70							0
6					13.10							0
7					6.80							0
8					6.50							0
9					5.10							0
10					11.60							0
11					15.60							0
12					14.50							0
13					16.90							0
14					4.70							0
15					4.40							0

** - Results not available (recorder out of service) * - Not recorded (Equipment not available)

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JANUARY 1986) (cont'd)

PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw **	Set *	Filter*	Treat.**	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	(°C)
16					3.10							0
17					3.00							1
18					12.70							1
19					12.50							1
20					13.90							1
21					6.00							1
22					10.50							1
23					6.70							1
24					9.40							1
25					12.90							0
26					14.50							0
27					6.50							0
28					8.70							0
29					9.70							0
30					9.60							0
31					9.40							0

TABLE 2.1: PARTICULATE REMOVAL PROFILE (MAY 1986)

MOE WPOS PROTOCOL

PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw**	Set *	Filter*	Treat.**	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	(°C)
1					1.10							10
2					1.60							10
3					1.60							9
4					2.00							8
5					1.10							9
6					2.00							10
7					1.50							9
8					2.80							9
9					3.50							10
10					5.20							10
11					0.80							10
12					2.70							12
13					1.50							12
14					2.30							12
15					2.20							12

** - Results not available (recorder out of service) * - Not recorded (Equipment not available)

PORT DOVER WATER TREATMENT PLANT

TABLE 2.1: PARTICULATE REMOVAL PROFILE (MAY 1986) (cont'd)

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP. (^{o}C)
	Raw **	Set *	Filter*	Treat.**	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	
16					3.80							12
17					1.60							12
18					1.70							12
19					2.40							12
20					1.70							13
21					1.50							12
22					3.50							12
23					2.70							11
24					3.30							10
25					3.80							10
26					3.80							10
27					3.50							14
28					5.10							16
29					4.30							13
30					2.70							10
31					2.90							10

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JULY/1986)

MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw **	Set *	Filter*	Treat.**	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	(°C)
1					5.00							13
2					3.70							13
3					4.10							16
4					4.20							16
5					4.00							17
6					1.20							17
7					4.60							17
8					4.40							16
9					4.80							16
10					4.10							16
11					3.40							18
12					3.60							18
13					4.20							18
14					4.60							20
15					3.60							20

** - Results not available (recorder out of service) * - Not recorded (Equipment not available)

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JULY/1986) (cont'd)

PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw **	Set *	Filter*	Treat.**	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	(^{o}C)
16					3.90							20
17					3.80							20
18					3.90							20
19					3.40							20
20					4.00							20
21					4.00							20
22					4.00							21
23					3.80							20
24					3.40							21
25					3.40							24
26					3.30							22
27					3.60							24
28					4.40							23
29					3.10							22
30					2.70							21
31					2.70							21

TABLE 2.1: PARTICULATE REMOVAL PROFILE (OCTOBER/1986)

MOE WPOS PROTOCOL

PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP. (^{o}C)
	Raw**	Set *	Filter*	Treat.**	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	
1					5.30							18
2					9.50							18
3					11.20							18
4					13.60							18
5					13.20							18
6					10.40							17
7					8.80							17
8					10.30							16
9					10.60							16
10					9.40							15
11					9.30							14
12					8.20							14
13					11.20							15
14					10.50							15
15					7.70							13

** - Results not available (recorder out of service)   * - Not recorded (Equipment not available)

TABLE 2.1: PARTICULATE REMOVAL PROFILE (OCTOBER/1986) (cont'd)

PORT DOVER WATER TREATMENT PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw **	Set *	Filter*	Treat.**	mg/L	mg/L	mg/L	Raw	Treat.	Raw	Treat.	(°C)
16					7.70							13
17					7.70							13
18					9.10							12
19					9.00							12
20					7.60							12
21					6.50							12
22					6.40							12
23					6.30							13
24					5.90							13
25					5.70							13
26					5.40							12
27					5.50							12
28					6.10							13
29					6.80							13
30					5.90							12
31					6.60							12

1984 - 1986

DISINFECTION YEARLY SUMMARY

TABLE 3.1

TABLE 3.1: DISINFECTION SUMMARY

MOE WPOS PROTOCOL

		1986						1985					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
JAN	Cl_2 Demand	1.84	0.19	0.82	0.46	0.00	0.17	3.02	0.29	1.23	0.76	0.00	0.34
	Cl_2 Dosage	2.00	0.98	1.34	0.43	0.14	0.24	3.62	1.27	1.85	0.77	0.26	0.54
	Ammonia	-	-	-	-	-	-	-	-	-	-	-	-
	SO_2	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Free	1.07	0.06	0.54	1.10	0.15	0.60	0.91	0.13	0.62	2.00	0.35	0.85
	Resid. CL_2 Comb.	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Total	-	-	-	-	-	-	-	-	-	-	-	-
FEB	Cl_2 Demand	2.01	0.55	0.91	0.48	0.00	0.15	2.90	0.34	1.08	0.94	0.00	0.44
	Cl_2 Dosage	2.58	1.24	1.42	0.37	0.15	0.23	3.35	1.21	1.75	0.99	0.18	0.44
	Ammonia	-	-	-	-	-	-	-	-	-	-	-	-
	SO_2	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Free	0.75	0.16	0.50	0.80	0.30	0.59	1.19	0.17	0.67	1.40	0.15	0.67
	Resid. CL_2 Comb.	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Total	-	-	-	-	-	-	-	-	-	-	-	-
MAR	Cl_2 Demand	1.34	0.16	0.89	1.03	0.0	0.31	1.56	0.16	0.90	0.59	0.00	0.19
	Cl_2 Dosage	1.80	0.74	1.39	1.18	0.14	0.36	2.02	0.51	1.61	0.43	0.00	0.18
	Ammonia	-	-	-	-	-	-	-	-	-	-	-	-
	SO_2	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Free	0.86	0.06	0.49	0.80	0.09	0.54	1.67	0.18	0.78	1.50	0.40	0.80
	Resid. CL_2 Comb.	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Total	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 3.1: (cont'd)

MOE WPOS PROTOCOL

		1986						1985					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
APR	Cl_2 Demand	1.57	0.76	1.10	0.69	0.00	0.26	2.29	0.68	1.29	0.67	0.00	0.16
	Cl_2 Dosage	1.84	1.11	1.47	0.71	0.14	0.34	2.70	1.34	1.86	0.32	0.00	0.15
	Ammonia	-	-	-	-	-	-	-	-	-	-	-	-
	SO_2	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Free	0.56	0.18	0.37	0.65	0.05	0.45	0.84	0.23	0.58	1.25	0.25	0.57
	Resid. CL_2 Comb.	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Total	-	-	-	-	-	-	-	-	-	-	-	-
MAY	Cl_2 Demand	1.58	0.76	1.09	1.23	0.00	1.24	2.08	0.41	0.99	0.46	0.00	0.17
	Cl_2 Dosage	1.96	1.30	1.58	1.13	0.14	0.52	2.67	1.04	1.63	0.39	0.06	0.17
	Ammonia	-	-	-	-	-	-	-	-	-	-	-	-
	SO_2	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Free	0.67	0.28	0.50	0.85	0.32	0.58	1.10	0.37	0.63	1.00	0.45	0.65
	Resid. CL_2 Comb.	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Total	-	-	-	-	-	-	-	-	-	-	-	-
JUN	Cl_2 Demand	1.85	1.04	1.46	0.87	0.00	0.42	1.09	0.31	0.77	0.55	0.00	0.18
	Cl_2 Dosage	2.23	1.47	1.83	1.01	0.17	0.55	1.54	0.83	1.25	0.43	0.00	0.16
	Ammonia	-	-	-	-	-	-	-	-	-	-	-	-
	SO_2	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Free	0.84	0.08	0.37	0.75	0.20	0.52	0.77	0.30	0.47	0.70	0.33	0.45
	Resid. CL_2 Comb.	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Total	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 3.1: (cont'd)

MOE WPOS PROTOCOL

		1986						1985					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
JUL	Cl_2 Demand	1.93	0.42	1.40	1.07	0.19	0.52	1.61	0.31	1.08	1.10	0.00	0.42
	Cl_2 Dosage	2.17	1.17	1.69	1.19	0.37	0.67	2.39	0.77	1.43	0.91	0.13	0.39
	Ammonia	-	-	-	-	-	-	-	-	-	-	-	-
	SO_2	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Free	0.40	0.04	0.29	0.65	0.22	0.41	1.47	0.10	0.40	0.90	0.15	0.37
	Resid. CL_2 Comb.	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Total	-	-	-	-	-	-	-	-	-	-	-	-
AUG	Cl_2 Demand	1.81	1.04	1.35	1.21	0.32	0.73	1.68	1.05	1.28	1.16	0.21	0.71
	Cl_2 Dosage	2.15	1.43	1.78	1.42	0.53	0.92	2.11	1.41	1.69	1.30	0.35	0.75
	Ammonia	-	-	-	-	-	-	-	-	-	-	-	-
	SO_2	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Free	0.76	0.13	0.43	1.30	0.20	0.62	0.63	0.12	0.41	0.75	0.10	0.44
	Resid. CL_2 Comb.	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Total	-	-	-	-	-	-	-	-	-	-	-	-
SEP	Cl_2 Demand	1.86	0.57	0.98	1.01	0.12	0.49	1.93	0.36	1.38	1.09	0.00	0.53
	Cl_2 Dosage	2.41	1.08	1.60	1.16	0.21	0.55	2.52	1.13	1.80	1.25	0.20	0.68
	Ammonia	-	-	-	-	-	-	-	-	-	-	-	-
	SO_2	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Free	0.88	0.41	0.62	1.10	0.35	0.68	1.33	0.12	0.43	1.10	0.31	0.57
	Resid. CL_2 Comb.	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Total	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 3.1: (cont'd)

MOE WPOS PROTOCOL

		1986						1985					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
OCT	Cl_2 Demand	1.92	0.39	1.14	0.92	0.00	0.47	1.76	0.51	1.20	0.50	0.00	0.24
	Cl_2 Dosage	2.31	0.84	1.65	1.05	0.19	0.58	2.11	1.21	1.70	0.55	0.15	0.36
	Ammonia	-	-	-	-	-	-	-	-	-	-	-	-
	SO_2	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Free	1.16	0.09	0.49	0.90	0.18	0.60	0.82	0.21	0.50	0.95	0.20	0.62
	Resid. CL_2 Comb.	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Total	-	-	-	-	-	-	-	-	-	-	-	-
NOV	Cl_2 Demand	1.88	0.59	0.95	0.65	0.00	0.31	3.00	0.75	1.60	0.59	0.00	0.25
	Cl_2 Dosage	1.88	1.11	1.46	0.73	0.18	0.47	3.37	1.32	2.04	0.63	0.15	0.34
	Ammonia	-	-	-	-	-	-	-	-	-	-	-	-
	SO_2	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Free	0.81	0.23	0.51	0.85	0.35	0.67	1.02	0.06	0.44	1.00	0.25	0.51
	Resid. CL_2 Comb.	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Total	-	-	-	-	-	-	-	-	-	-	-	-
DEC	Cl_2 Demand	1.46	0.34	1.01	0.79	0.00	0.21	2.92	0.56	1.03	0.73	0.00	0.20
	Cl_2 Dosage	1.86	1.13	1.55	0.83	0.09	0.42	3.02	1.12	1.53	0.90	0.14	0.28
	Ammonia	-	-	-	-	-	-	-	-	-	-	-	-
	SO_2	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Free	0.79	0.19	0.54	1.10	0.40	0.76	0.83	0.10	0.49	1.20	0.20	0.57
	Resid. CL_2 Comb.	-	-	-	-	-	-	-	-	-	-	-	-
	Resid. CL_2 Total	-	-	-	-	-	-	-	-	-	-	-	-

NOTE: Document - Method of sample collection - Method of analyses, frequency, and by whom

TABLE 3.1: DISINFECTION SUMMARY

MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

		1984						1983					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
JAN	Cl_2 Demand	--	--	--	--	--	--						
	Cl_2 Dosage	1.94	0.80	1.29	0.36	0.11	0.18						
	Ammonia	--	--	--	--	--	--						
	SO_2	--	--	--	--	--	--						
	Resid. CL_2 Free	**	**	**	**	**	**						
	Resid. CL_2 Comb.	--	--	--	--	--	--						
	Resid. CL_2 Total	--	--	--	--	--	--						
FEB	Cl_2 Demand	--	--	--	--	--	--						
	Cl_2 Dosage	3.72	0.84	1.37	0.84	0.00	0.31						
	Ammonia	--	--	--	--	--	--						
	SO_2	--	--	--	--	--	--						
	Resid. CL_2 Free	**	**	**	**	**	**						
	Resid. CL_2 Comb.	--	--	--	--	--	--						
	Resid. CL_2 Total	--	--	--	--	--	--						
MAR	Cl_2 Demand	1.89	0.37	1.10	0.78	0.00	0.31						
	Cl_2 Dosage	2.24	0.79	1.65	0.48	0.00	0.27						
	Ammonia	--	--	--	--	--	--						
	SO_2	--	--	--	--	--	--						
	Resid. CL_2 Free	1.00	0.00	0.58	1.00	0.15	0.54						
	Resid. CL_2 Comb.	--	--	--	--	--	--						
	Resid. CL_2 Total	--	--	--	--	--	--						

TABLE 3.1: (cont'd)

MOE WPOS PROTOCOL

		1984						1983					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
APR	Cl_2 Demand	1.82	0.59	1.31	0.52	0.00	0.21						
	Cl_2 Dosage	2.03	1.42	1.68	0.62	0.14	0.36						
	Ammonia	--	--	--	--	--	--						
	SO_2	--	--	--	--	--	--						
	Resid. CL_2 Free	1.00	0.10	0.86	1.00	0.25	0.53						
	Resid. CL_2 Comb.	--	--	--	--	--	--						
	Resid. CL_2 Total	--	--	--	--	--	--						
MAY	Cl_2 Demand	2.56	0.90	1.68	0.80	0.00	0.27						
	Cl_2 Dosage	2.96	1.30	2.02	0.80	0.20	0.41						
	Ammonia	--	--	--	--	--	--						
	SO_2	--	--	--	--	--	--						
	Resid. CL_2 Free	1.00	0.10	0.38	1.00	0.25	0.52						
	Resid. CL_2 Comb.	--	--	--	--	--	--						
	Resid. CL_2 Total	--	--	--	--	--	--						
JUN	Cl_2 Demand	2.94	0.96	1.77	0.57	0.00	0.24						
	Cl_2 Dosage	3.23	1.09	2.07	0.60	0.20	0.38						
	Ammonia	--	--	--	--	--	--						
	SO_2	--	--	--	--	--	--						
	Resid. CL_2 Free	1.00	0.10	0.30	1.50	0.25	0.48						
	Resid. CL_2 Comb.	--	--	--	--	--	--						
	Resid. CL_2 Total	--	--	--	--	--	--						

TABLE 3.1: (cont'd)

MOE WPOS PROTOCOL

		1984						1983					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
JUL	Cl_2 Demand	--	--	--	--	--	--						
	Cl_2 Dosage	2.70	1.65	1.93	0.63	0.17	0.38						
	Ammonia	--	--	--	--	--	--						
	SO_2	--	--	--	--	--	--						
	Resid. CL_2 Free	**	**	**	**	**	**						
	Resid. CL_2 Comb.	--	--	--	--	--	--						
	Resid. CL_2 Total	--	--	--	--	--	--						
AUG	Cl_2 Demand	--	--	--	--	--	--						
	Cl_2 Dosage	2.62	1.43	1.94	0.84	0.15	0.44						
	Ammonia												
	SO_2												
	Resid. CL_2 Free	**	**	**	**	**	**						
	Resid. CL_2 Comb.	--	--	--	--	--	--						
	Resid. CL_2 Total	--	--	--	--	--	--						
SEP	Cl_2 Demand	--	--	--	--	--	--						
	Cl_2 Dosage	2.56	1.16	1.79	0.78	0.40	0.54						
	Ammonia												
	SO_2												
	Resid. CL_2 Free	**	**	**	1.25	0.30	0.58						
	Resid. CL_2 Comb.	--	--	--	--	--	--						
	Resid. CL_2 Total	--	--	--	--	--	--						

TABLE 3.1: (cont'd)

MOE WPOS PROTOCOL

		1984						1983					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
OCT	Cl_2 Demand	--	--	--	--	--	--						
	Cl_2 Dosage	2.46	0.74	1.63	1.00	0.22	0.51						
	Ammonia	--	--	--	--	--	--						
	SO_2	--	--	--	--	--	--						
	Resid. CL_2 Free	**	**	**	1.00	0.35	0.75						
	Resid. CL_2 Comb.	--	--	--	--	--	--						
	Resid. CL_2 Total	--	--	--	--	--	--						
NOV	Cl_2 Demand	--	--	--	--	--	--						
	Cl_2 Dosage	2.64	1.00	1.75	4.07	0.56	1.34						
	Ammonia	--	--	--	--	--	--						
	SO_2	--	--	--	--	--	--						
	Resid. CL_2 Free	**	**	**	1.00	0.50	0.85						
	Resid. CL_2 Comb.	--	--	--	--	--	--						
	Resid. CL_2 Total	--	--	--	--	--	--						
DEC	Cl_2 Demand	--	--	--	--	--	--						
	Cl_2 Dosage	1.89	1.19	1.56	0.64	0.28	0.46						
	Ammonia	--	--	--	--	--	--						
	SO_2	--	--	--	--	--	--						
	Resid. CL_2 Free	**	**	**	1.00	0.50	0.66						
	Resid. CL_2 Comb.	--	--	--	--	--	--						
	Resid. CL_2 Total	--	--	--	--	--	--						

TABLE 3.1: DISINFECTION SUMMARY DOAN'S HOLLOW INFILTRATION GALLERY
MOE WPOS PROTOCOL

		1986						1985					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
JAN	Cl_2 Demand				**	**	**				1.91	0.41	1.13
	Cl_2 Dosage										3.17	1.66	2.26
	Ammonia												
	SO_2												
	Resid. CL_2 Free										1.75	0.80	1.14
	Resid. CL_2 Comb.										--	--	--
	Resid. CL_2 Total										--	--	--
FEB	Cl_2 Demand				**	**	**				2.51	0.41	1.23
	Cl_2 Dosage										2.91	1.66	2.20
	Ammonia												
	SO_2												
	Resid. CL_2 Free										1.50	0.40	0.97
	Resid. CL_2 Comb.										--	--	--
	Resid. CL_2 Total										--	--	--
MAR	Cl_2 Demand				**	**	**				1.38	0.41	0.95
	Cl_2 Dosage										2.91	0.80	1.94
	Ammonia												
	SO_2												
	Resid. CL_2 Free										2.00	0.70	0.99
	Resid. CL_2 Comb.										--	--	--
	Resid. CL_2 Total										--	--	--

** - Records not available.

TABLE 3.1: (cont'd)

MOE WPOS PROTOCOL

		1986						1985					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
APR	Cl_2 Demand				1.51	0.20	0.76				**	**	**
	Cl_2 Dosage				2.10	0.54	1.44				**	**	**
	Ammonia				--	--	--						
	SO_2				--	--	--						
	Resid. CL_2 Free				1.70	0.40	0.68				**	**	**
	Resid. CL_2 Comb.				--	--	--						
	Resid. CL_2 Total				--	--	--						
MAY	Cl_2 Demand				1.27	0.13	0.72				**	**	**
	Cl_2 Dosage				2.16	1.04	1.68				**	**	**
	Ammonia				--	--	--						
	SO_2				--	--	--						
	Resid. CL_2 Free				1.20	0.74	0.96				**	**	**
	Resid. CL_2 Comb.				--	--	--						
	Resid. CL_2 Total				--	--	--						
JUN	Cl_2 Demand				3.66	0.54	1.05				**	**	**
	Cl_2 Dosage				4.16	1.61	2.02				**	**	**
	Ammonia				--	--	--						
	SO_2				--	--	--						
	Resid. CL_2 Free				1.80	0.50	0.98				**	**	**
	Resid. CL_2 Comb.				--	--	--						
	Resid. CL_2 Total				--	--	--						

** - Switches to liquid chlorine

TABLE 3.1: (cont'd)

MOE WPOS PROTOCOL

		1986						1985					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
JUL	Cl_2 Demand				1.06	0.67	0.93				2.10	0.00	1.02
	Cl_2 Dosage				2.01	1.86	1.93				2.70	1.04	1.81
	Ammonia												
	SO_2												
	Resid. CL_2 Free				1.21	0.05	1.00				1.40	0.60	0.78
	Resid. CL_2 Comb.				--	--	--						
	Resid. CL_2 Total				--	--	--						
AUG	Cl_2 Demand				1.27	0.51	0.82				2.53	0.45	1.05
	Cl_2 Dosage				2.01	1.64	1.84				2.38	1.15	1.76
	Ammonia												
	SO_2												
	Resid. CL_2 Free				1.30	0.70	1.02				1.15	0.10	0.71
	Resid. CL_2 Comb.				--	--	--				--	--	--
	Resid. CL_2 Total				--	--	--				--	--	--
SEP	Cl_2 Demand				1.47	0.13	0.73				1.58	0.28	0.83
	Cl_2 Dosage				2.20	1.19	1.75				2.08	0.83	1.52
	Ammonia												
	SO_2												
	Resid. CL_2 Free				1.55	0.50	1.02				1.60	0.30	0.69
	Resid. CL_2 Comb.				--	--	--				--	--	--
	Resid. CL_2 Total				--	--	--				--	--	--

TABLE 3.1: (cont'd)

MOE WPOS PROTOCOL

		1986						1985					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
OCT	Cl_2 Demand				1.28	0.29	0.81				**	**	**
	Cl_2 Dosage				2.35	1.43	1.82				**	**	**
	Ammonia												
	SO_2												
	Resid. CL_2 Free				1.50	0.56	1.01				**	**	**
	Resid. CL_2 Comb.				--	--	--				--	--	--
	Resid. CL_2 Total				--	--	--				--	--	--
NOV	Cl_2 Demand				0.98	0.12	0.65				1.59	6.66	1.09
	Cl_2 Dosage				1.84	1.12	1.46				2.63	1.66	2.05
	Ammonia												
	SO_2												
	Resid. CL_2 Free				1.30	0.45	0.81				1.25	0.60	0.96
	Resid. CL_2 Comb.				--	--	--				--	--	--
	Resid. CL_2 Total				--	--	--				--	--	--
DEC	Cl_2 Demand				0.63	0.03	0.44				1.30	0.81	1.06
	Cl_2 Dosage				1.43	1.00	1.19				2.00	1.66	1.83
	Ammonia												
	SO_2												
	Resid. CL_2 Free				1.10	0.54	0.75				0.85	0.70	0.78
	Resid. CL_2 Comb.				--	--	--				--	--	--
	Resid. CL_2 Total				--	--	--				--	--	--

TABLE 3.1: DISINFECTION SUMMARY DOAN'S HOLLOW INFILTRATION GALLERY
MOE WPOS PROTOCOL

		1984						1983					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
JAN	Cl_2 Demand				1.83	0.03	0.48						
	Cl_2 Dosage				3.10	0.88	1.56						
	Ammonia												
	SO_2												
	Resid. CL_2 Free												
	Resid. CL_2 Comb.				3.00	0.25	1.08						
	Resid. CL_2 Total												
FEB	Cl_2 Demand				1.50	0.00	0.66						
	Cl_2 Dosage				2.00	0.83	1.34						
	Ammonia												
	SO_2												
	Resid. CL_2 Free												
	Resid. CL_2 Comb.				1.25	0.30	0.68						
	Resid. CL_2 Total												
MAR	Cl_2 Demand				1.68	0.00	0.99						
	Cl_2 Dosage				2.08	1.25	1.81						
	Ammonia												
	SO_2												
	Resid. CL_2 Free												
	Resid. CL_2 Comb.				1.66	0.30	0.82						
	Resid. CL_2 Total												

TABLE 3.1: (cont'd)

MOE WPOS PROTOCOL

		1984						1983					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
APR	Cl_2 Demand				2.40	0.16	1.10						
	Cl_2 Dosage				2.91	1.25	2.07						
	Ammonia												
	SO_2												
	Resid. CL_2 Free												
	Resid. CL_2 Comb.				1.50	0.30	0.97						
	Resid. CL_2 Total												
MAY	Cl_2 Demand				1.79	0.37	0.98						
	Cl_2 Dosage				2.49	1.66	2.00						
	Ammonia												
	SO_2												
	Resid. CL_2 Free												
	Resid. CL_2 Comb.				1.70	0.40	1.02						
	Resid. CL_2 Total												
JUN	Cl_2 Demand				2.43	2.43	2.43						
	Cl_2 Dosage				3.43	3.43	3.43						
	Ammonia												
	SO_2												
	Resid. CL_2 Free												
	Resid. CL_2 Comb.				1.00	1.00	1.00						
	Resid. CL_2 Total												

TABLE 3.1: (cont'd)

MOE WPOS PROTOCOL

		1984						1983					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
JUL	Cl_2 Demand				1.89	0.37	1.18						
	Cl_2 Dosage				2.49	1.87	2.21						
	Ammonia												
	SO_2												
	Resid. CL_2 Free												
	Resid. CL_2 Comb.				1.50	0.60	1.03						
	Resid. CL_2 Total												
AUG	Cl_2 Demand				3.14	0.58	1.40						
	Cl_2 Dosage				3.74	1.66	2.40						
	Ammonia												
	SO_2												
	Resid. CL_2 Free												
	Resid. CL_2 Comb.				1.75	0.40	1.01						
	Resid. CL_2 Total												
SEP	Cl_2 Demand				2.94	0.21	1.66						
	Cl_2 Dosage				3.74	1.46	2.67						
	Ammonia												
	SO_2												
	Resid. CL_2 Free												
	Resid. CL_2 Comb.				1.50	0.20	1.00						
	Resid. CL_2 Total												

TABLE 3.1: (cont'd)

MOE WPOS PROTOCOL

		1984						1983					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
OCT	Cl_2 Demand				2.11	0.99	1.53						
	Cl_2 Dosage				3.33	2.08	2.77						
	Ammonia												
	SO_2												
	Resid. CL_2 Free												
	Resid. CL_2 Comb.				1.50	0.80	1.24						
	Resid. CL_2 Total												
NOV	Cl_2 Demand												
	Cl_2 Dosage												
	Ammonia												
	SO_2												
	Resid. CL_2 Free												
	Resid. CL_2 Comb.												
	Resid. CL_2 Total												
DEC	Cl_2 Demand				2.73	0.66	1.30						
	Cl_2 Dosage				3.33	1.66	2.19						
	Ammonia												
	SO_2												
	Resid. CL_2 Free												
	Resid. CL_2 Comb.				1.25	0.20	0.89						
	Resid. CL_2 Total												

NOTE: Document - Method of sample collection - Method of analyses, frequency, and by whom

1984

DISINFECTION PROFILE
(JANUARY, MAY, JULY, OCTOBER)

TABLE 3.2

TABLE 3.2: DISINFECTION PROFILE JANUARY 1984

MOE WPOS PROTOCOL

PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free **	Comb.	Total	Dem.	Dos.			Free *	Comb.	Total
1		1.37							0.21			0.75		
2		2.14							0.11			0.63		
3		1.60							0.18			1.63		
4		1.91							0.36			1.13		
5		1.78							0.12			0.30		
6		1.31							0.20			0.75		
7		1.94							0.30			0.75		
8		1.71							0.24			0.90		
9		1.28							0.12			1.00		
10		1.03							0.11			0.50		
11		1.38							0.12			0.50		
12		1.17							0.13			0.33		
13		1.30							0.13			0.35		
14		1.28							0,13			0.50		
15		1.54							0.28			0.40		

* Free residual listed as average of High and Low for day.
** Data not recorded.

TABLE 3.2: JANUARY 1984 (cont'd) PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free **	Comb.	Total	Dem.	Dos.			Free *	Comb.	Total
16		1.40							0.14			0.45		
17		1.38							0.13			0.45		
18		1.32							0.13			0.40		
19		1.33							0.13			0.40		
20		1.19							0.13			0.33		
21		1.38							0.13			0.23		
22		0.80							0.27			0.25		
23		1.03							0.26			0.25		
24		0.83							0.28			0.50		
25		0.93							0.13			0.38		
26		0.93							0.12			0.33		
27		0.86							0.25			0.33		
28		0.91							0.11			0.45		
29		0.81							0.20			0.38		
30		0.90							0.23			0.25		
31		1.12							0.11			0.50		

TABLE 3.2: DISINFECTION PROFILE (JANUARY 1984)

MOE WPOS PROTOCOL

PORT DOVER
DOAN'S HOLLOW INFILTRATION GALLERY

DATE	PRE-CHLORINATION Cl_2 Dem.	Dos.	NH_3	SO_2	RESIDUAL CL_2 Free	Comb.	Total	POST-CHLORINATION Cl_2 Dem.	Dos.	NH_3	SO_2	RESIDUAL CL_2 Free	Comb.	Total
1								*	*			*		
2								*	*			*		
3								*	*			*		
4								*	*			*		
5								*	*			*		
6								*	*			*		
7								*	*			*		
8								*	*			*		
9								*	*			*		
10								*	*			*		
11								*	*			*		
12								*	*			*		
13								*	*			*		
14								*	*			*		
15								*	*			*		

* PLANT NOT IN OPERATION.

TABLE 3.2: JAN. 1984 (cont'd) PORT DOVER - DOAN'S HOLLOW INFILTRATION GALLERY

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
16								*	*			*		
17								*	*			*		
18								*	*			*		
19								*	*			*		
20								*	*			*		
21								*	*			*		
22								*	*			*		
23								*	*			*		
24								0.10	3.10			3.00		
25								1.83	2.08			0.25		
26								0.63	1.33			0.70		
27								0.05	1.55			1.50		
28								0.03	1.33			1.30		
29								0.30	1.10			0.80		
30								0.28	0.88			0.60		
31								0.61	1.11			0.50		

TABLE 3.2: DISINFECTION PROFILE MAY 1984

MOE WPOS PROTOCOL

PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
1	1.30	1.60			0.30			0.22	0.27			0.35		
2	1.95	2.15			0.20			0.37	0.52			0.35		
3	1.88	2.18			0.30			0.04	0.24			0.50		
4	1.57	1.77			0.20			0.10	0.30			0.40		
5	1.20	1.50			0.30			0.27	0.27			0.30		
6	1.37	1.67			0.30			0.51	0.46			0.25		
7	1.37	1.62			0.25			0.09	0.44			0.60		
8	1.60	1.90			0.30			0.10	0.40			0.60		
9	1.63	1.88			0.25			0.00	0.46			0.75		
10	1.40	1.65			0.25			0.22	0.47			0.50		
11	1.31	1.71			0.40			0.46	0.46			0.40		
12	1.67	1.82			0.15			0.00	0.57			0.75		
13	1.29	1.49			0.20			0.00	0.20			0.50		
14	1.11	1.46			0.35			0.33	0.43			0.45		
15	2.56	2.66			0.10			0.19	0.54			0.45		

TABLE 3.2: MAY 1984 (cont'd)

PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
16	1.63	1.88			0.25			0.00	0.39			0.75		
17	1.73	2.23			0.50			0.26	0.26			0.50		
18	2.24	2.64			0.40			0.48	0.48			0.40		
19	1.73	2.13			0.40			0.47	0.57			0.50		
20	1.96	2.46			0.50			0.19	0.29			0.60		
21	1.86	2.36			0.50			0.28	0.28			0.50		
22	2.48	2.88			0.40			0.32	0.42			0.50		
23	1.91	2.31			0.40			0.34	0.44			0.50		
24	1.65	2.65			1.00			0.43	0.43			1.00		
25	2.10	2.60			0.50			0.32	0.32			0.50		
26	2.15	2.65			0.50			0.43	0.43			0.50		
27	2.46	2.96			0.50			0.52	0.52			0.50		
28	1.81	2.56			0.75			0.80	0.80			0.75		
29	1.22	1.62			0.40			0.21	0.31			0.50		
30	0.90	1.30			0.40			0.21	0.31			0.50		
31	0.90	1.30			0.40			0.25	0.45			0.60		

TABLE 3.2: DISINFECTION PROFILE (MAY 1984)

MOE WPOS PROTOCOL

PORT DOVER
DOAN'S HOLLOW INFILTRATION GALLERY

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
1								1.08	2.08			1.00		
2								0.99	2.49			1.50		
3								1.28	2.28			1.00		
4								1.68	2.08			0.40		
5								1.79	2.49			0.70		
6								1.08	2.08			1.00		
7								0.37	1.87			1.50		
8								0.88	2.08			1.20		
9								0.17	1.87			1.70		
10								0.66	1.66			1.00		
11								0.76	1.66			0.90		
12								1.06	1.66			0.60		
13								0.88	1.66			0.80		
14								*	*			*		
15								*	*			*		

* PLANT NOT IN OPERATION.

TABLE 3.2: **MAY 1984** (cont'd)

PORT DOVER - DOAN'S HOLLOW INFILTRATION GALLERY

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
16								*	*			*		
17								*	*			*		
18								*	*			*		
19								*	*			*		
20								*	*			*		
21								*	*			*		
22								*	*			*		
23								*	*			*		
24								*	*			*		
25								*	*			*		
26								*	*			*		
27								*	*			*		
28								*	*			*		
29								*	*			*		
30								*	*			*		
31								*	*			*		

TABLE 3.2: DISINFECTION PROFILE JULY 1984

MOE WPOS PROTOCOL

PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION Cl_2 Dem.	Cl_2 Dos.	NH_3	SO_2	RESIDUAL CL_2 Free **	Comb.	Total	POST-CHLORINATION Cl_2 Dem.	Cl_2 Dos.	NH_3	SO_2	RESIDUAL CL_2 Free	Comb.	Total
1		1.76							0.27			0.35		
2		1.84							0.25			0.40		
3		1.76							0.26			0.40		
4		1.88							0.26			0.40		
5		1.70							0.38			0.25		
6		1.99							0.30			0.25		
7		1.98							0.30			0.35		
8		1.81							0.28			0.50		
9		1.65							0.27			0.50		
10		1.71							0.26			0.25		
11		1.87							0.40			0.25		
12		1.86							0.26			0.40		
13		2.00							0.38			0.40		
14		1.92							0.36			0.45		
15		1.86							0.46			0.50		

** Data not recorded.

TABLE 3.2: JULY 1984 (cont'd) PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free **	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
16		2.12							0.46			0.50		
17		2.10							0.35			0.50		
18		1.80							0.40			0.40		
19		1.95							0.37			0.50		
20		2.70							0.36			0.40		
21		1.83							0.53			0.40		
22		1.95							0.48			0.30		
23		1.75							0.41			0.25		
24		1.92							0.53			0.40		
25		1.82							0.54			0.35		
26		2.08							0.17			0.35		
27		2.32							0.41			0.35		
28		2.09							0.63			0.35		
29		1.80							0.53			0.50		
30		2.02							0.45			0.75		
31		1.99							0.61			0.60		

TABLE 3.2: DISINFECTION PROFILE (JULY 1984)

MOE WPOS PROTOCOL

PORT DOVER
DOAN'S HOLLOW INFILTRATION GALLERY

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
1								*	*			*		
2								*	*			*		
3								*	*			*		
4								*	*			*		
5								*	*			*		
6								*	*			*		
7								*	*			*		
8								*	*			*		
9								*	*			*		
10								*	*			*		
11								*	*			*		
12								*	*			*		
13								*	*			*		
14								*	*			*		
15								*	*			*		

* PLANT NOT IN OPERATION.

TABLE 3.2: JULY /1984 (cont'd)

PORT DOVER - DOAN'S HOLLOW INFILTRATION GALLERY

DATE	PRE-CHLORINATION Cl_2				PRE-CHLORINATION RESIDUAL CL_2			POST-CHLORINATION Cl_2				POST-CHLORINATION RESIDUAL CL_2		
	Dem.	Dos.	NH_3	SO_2	Free	Comb.	Total	Dem.	Dos.	NH_3	SO_2	Free	Comb.	Total
16								1.07	2.32			1.25		
17								1.89	2.49			0.60		
18								0.87	1.87			1.00		
19								1.49	2.29			0.80		
20								1.49	2.49			1.00		
21								1.08	2.08			1.00		
22								1.29	2.49			1.20		
23								0.77	1.87			1.10		
24								1.29	2.29			1.00		
25								1.49	2.29			0.80		
26								1.29	2.29			1.00		
27								0.37	1.87			1.50		
28								1.04	2.29			1.25		
29								1.08	2.08			1.00		
30								1.49	2.49			1.00		
31								0.87	1.87			1.00		

TABLE 3.2: DISINFECTION PROFILE OCTOBER 1984

MOE WPOS PROTOCOL

PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free **	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
1		1.20							0.22			0.60		
2		1.80							0.23			0.50		
3		1.84							0.25			0.60		
4		1.58							0.49			0.60		
5		1.89							1.00			0.60		
6		1.71							0.53			0.75		
7		1.87							0.29			0.75		
8		1.88							0.44			0.75		
9		1.55							0.45			0.75		
10		1.71							0.64			0.35		
11		1.36							0.58			0.60		
12		1.43							0.51			0.80		
13		1.40							0.46			0.60		
14		1.65							0.49			0.80		
15		1.48							0.33			0.75		

** Data not recorded.

TABLE 3.2: OCTOBER 1984 (cont'd) PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION Cl_2 Dem.	Cl_2 Dos.	NH_3	SO_2	RESIDUAL CL_2 Free **	Comb.	Total	POST-CHLORINATION Cl_2 Dem.	Cl_2 Dos.	NH_3	SO_2	RESIDUAL CL_2 Free	Comb.	Total
16		1.54							0.48			0.75		
17		1.34							0.48			0.75		
18		2.46							0.63			0.60		
19		1.82							0.65			1.00		
20		1.48							0.34			1.00		
21		1.45							0.59			0.75		
22		1.98							0.78			0.90		
23		1.89							0.28			1.00		
24		1.60							0.73			0.80		
25		2.01							0.53			1.00		
26		1.37							0.54			1.00		
27		1.43							0.77			0.50		
28		1.47							0.48			1.00		
29		1.81							0.75			0.60		
30		1.79							0.53			0.90		
31		0.74							0.51			0.80		

TABLE 3.2: DISINFECTION PROFILE (OCTOBER 1984)

MOE WPOS PROTOCOL

PORT DOVER
DOAN'S HOLLOW INFILTRATION GALLERY

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
1								0.99	2.49			1.50		
2								2.08	3.33			1.25		
3								1.66	2.91			1.25		
4								1.08	2.08			1.00		
5								1.49	2.49			1.00		
6								2.11	2.91			0.80		
7								1.41	2.91			1.50		
8								1.41	2.91			1.50		
9								*	*			*		
10								*	*			*		
11								*	*			*		
12								*	*			*		
13								*	*			*		
14								*	*			*		
15								*	*			*		

* INFORMATION NOT AVAILABLE.

TABLE 3.2: OCT. 1984 (cont'd) PORT DOVER - DOAN'S HOLLOW INFILTRATION GALLERY

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
16								*	*			*		
17								*	*			*		
18								*	*			*		
19								*	*			*		
20								*	*			*		
21								*	*			*		
22								1.24	2.49			1.25		
23								1.49	2.49			1.00		
24								1.24	2.49			1.25		
25								1.70	2.70			1.00		
26								1.87	3.12			1.25		
27								1.66	2.91			1.25		
28								1.41	2.91			1.50		
29								1.83	3.33			1.50		
30								1.24	2.49			1.25		
31								1.71	2.91			1.20		

1985

DISINFECTION PROFILE
(JANUARY, MAY, JULY, OCTOBER)

TABLE 3.2

TABLE 3.2: DISINFECTION PROFILE (JANUARY/1985)

MOE WPOS PROTOCOL

PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
1	1.73	1.86			0.13			0.06	0.43			0.50		
2	1.47	1.73			0.26			0.29	0.53			0.50		
3	1.41	1.89			0.48			0.12	0.39			0.75		
4	1.40	2.06			0.66			0.41	0.45			0.70		
5	1.72	1.90			0.18			0.34	0.51			0.35		
6	3.02	3.62			0.60			0.65	0.55			0.50		
7	N.A.	1.68			N.A.			N.A.	0.60			2.00		
8	0.90	1.58			0.68			0.25	0.57			1.00		
9	1.22	1.80			0.58			0.12	0.54			1.00		
10	1.24	1.82			0.58			0.43	0.60			0.75		
11	1.25	1.82			0.57			0.14	0.29			1.00		
12	1.52	2.10			0.58			0.69	0.61			0.50		
13	0.93	1.50			0.57			0.12	0.55			1.00		
14	1.68	2.35			0.67			0.46	0.54			0.75		
15	1.46	2.20			0.74			0.76	0.77			0.75		

TABLE 3.2: JANUARY/1985 (cont'd)

PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION Cl_2 Dem.	PRE-CHLORINATION Cl_2 Dos.	PRE-CHLORINATION NH_3	PRE-CHLORINATION SO_2	PRE-CHLORINATION RESIDUAL CL_2 Free	PRE-CHLORINATION RESIDUAL CL_2 Comb.	PRE-CHLORINATION RESIDUAL CL_2 Total	POST-CHLORINATION Cl_2 Dem.	POST-CHLORINATION Cl_2 Dos.	POST-CHLORINATION NH_3	POST-CHLORINATION SO_2	POST-CHLORINATION RESIDUAL CL_2 Free	POST-CHLORINATION RESIDUAL CL_2 Comb.	POST-CHLORINATION RESIDUAL CL_2 Total
16	1.23	1.96			0.73			0.27	0.54			1.00		
17	1.21	1.71			0.50			0.10	0.60			1.00		
18	1.34	1.91			0.57			0.17	0.60			1.00		
19	1.10	1.75			0.65			0.48	0.58			0.75		
20	1.47	2.21			0.74			0.50	0.51			0.75		
21	1.02	1.48			0.46			0.41	0.55			0.60		
22	1.66	2.08			0.42			0.24	0.57			0.75		
23	0.66	1.39			0.73			0.41	0.58			0.90		
24	0.67	1.58			0.91			0.57	0.66			1.00		
25	0.72	1.54			0.82			0.36	0.29			0.75		
26	1.16	1.95			0.79			0.53	0.74			1.00		
27	0.80	1.59			0.79			0.33	0.54			1.00		
28	0.76	1.67			0.91			0.00	0.48			1.40		
29	0.29	1.27			0.98			0.24	0.26			1.00		
30	1.02	1.66			0.64			0.45	0.56			0.75		
31	0.74	1.53			0.79			0.60	0.56			0.75		

TABLE 3.2: DISINFECTION PROFILE (JANUARY 1985)

PORT DOVER
DOAN'S HOLLOW INFILTRATION GALLEY

MOE WPOS PROTOCOL

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
1								1.49	2.49			1.00		
2								*	*			*		
3								*	*			*		
4								*	*			*		
5								*	*			*		
6								*	*			*		
7								1.67	3.17			1.50		
8								0.83	2.08			1.25		
9								1.08	2.08			1.00		
10								1.49	2.49			1.00		
11								1.08	2.08			1.00		
12								0.66	1.66			1.00		
13								1.49	2.49			0.80		
14								1.69	2.49			0.80		
15								1.71	2.91			1.20		

* Plant not in operation.

TABLE 3.2: JANUARY 1985 (cont'd) DOAN'S HOLLOW INFILTRATION PLANT - PORT DOVER

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
16								1.16	2.91			1.75		
17								0.99	2.49			1.50		
18								0.41	1.66			1.25		
19								1.91	2.91			1.00		
20								0.83	2.08			1.25		
21								0.58	2.08			1.50		
22								0.79	2.29			1.50		
23								0.62	1.87			1.25		
24								1.49	2.49			1.25		
25								1.28	2.08			0.80		
26								0.66	1.66			1.00		
27								1.08	2.08			1.00		
28								1.49	2.49			1.00		
29								1.18	2.08			0.90		
30								0.66	1.66			1.00		
31								1.08	2.08			1.00		

TABLE 3.2: DISINFECTION PROFILE (MAY/1985)

MOE WPOS PROTOCOL

PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION Cl_2				RESIDUAL CL_2			POST-CHLORINATION Cl_2				RESIDUAL CL_2		
	Dem.	Dos.	NH_3	SO_2	Free	Comb.	Total	Dem.	Dos.	NH_3	SO_2	Free	Comb.	Total
1	1.23	2.33			1.10			0.00	0.07			1.00		
2	2.08	2.67			0.59			0.18	0.24			0.65		
3	1.65	2.08			0.43			0.08	0.15			0.50		
4	1.57	2.07			0.50			0.00	0.17			0.70		
5	1.33	1.70			0.37			0.21	0.34			0.50		
6	1.82	2.32			0.50			0.15	0.15			0.50		
7	1.26	1.83			0.57			0.20	0.33			0.70		
8	0.97	1.85			0.88			0.34	0.16			0.70		
9	0.82	1.39			0.57			0.23	0.16			0.50		
10	1.08	1.65			0.57			0.40	0.33			0.50		
11	1.03	1.47			0.44			0.23	0.29			0.50		
12	0.92	1.49			0.57			0.46	0.39			0.50		
13	1.11	1.80			0.69			0.13	0.14			0.70		
14	0.57	1.27			0.70			0.15	0.15			0.70		
15	0.87	1.63			0.76			0.26	0.30			0.80		

TABLE 3.2: MAY /1985 (cont'd) PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
16	0.64	1.45			0.81			0.15	0.14			0.80		
17	1.20	1.79			0.59			0.00	0.15			0.85		
18	0.84	1.58			0.74			0.34	0.30			0.70		
19	0.65	1.30			0.65			0.16	0.16			0.65		
20	1.03	1.73			0.70			0.14	0.14			0.70		
21	0.89	1.41			0.52			0.07	0.15			0.60		
22	0.55	1.45			0.90			0.17	0.07			0.80		
23	1.03	1.59			0.56			0.00	0.06			0.65		
24	0.69	1.21			0.52			0.00	0.07			0.70		
25	0.86	1.51			0.65			0.07	0.07			0.65		
26	0.78	1.47			0.69			0.18	0.14			0.65		
27	0.41	1.04			0.63			0.18	0.15			0.60		
28	0.70	1.30			0.60			0.23	0.08			0.45		
29	0.75	1.30			0.55			0.17	0.07			0.45		
30	0.68	1.32			0.64			0.11	0.07			0.60		
31	0.71	1.38			0.67			0.15	0.08			0.60		

TABLE 3.2: DISINFECTION PROFILE (MAY 1985)

MOE WPOS PROTOCOL

PORT DOVER
DOAN'S HOLLOW INFILTRATION GALLERY

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														

NO INFORMATION AVAILABLE.

TABLE 3.2: MAY 1985 (cont'd)

DOAN'S HOLLOW INFILTRATION GALLERY - PORT DOVER

DATE	PRE-CHLORINATION Cl_2 Dem.	Dos.	NH_3	SO_2	RESIDUAL CL_2 Free	Comb.	Total	POST-CHLORINATION Cl_2 Dem.	Dos.	NH_3	SO_2	RESIDUAL CL_2 Free	Comb.	Totsl
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														

TABLE 3.2: DISINFECTION PROFILE (JULY/1985)

MOE WPOS PROTOCOL

PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
1	0.68	1.31			0.63			0.50	0.29			0.42		
2	0.31	1.08			0.77			0.30	0.13			0.60		
3	0.81	1.48			0.67			0.36	0.24			0.55		
4	0.57	1.19			0.62			0.47	0.35			0.50		
5	1.07	1.35			0.28			0.35	0.27			0.20		
6	1.54	1.95			0.41			0.20	0.29			0.50		
7	0.41	1.49			1.08			0.50	0.32			0.90		
8	0.86	1.62			0.76			0.30	0.14			0.60		
9	1.56	2.39			0.83			0.52	0.14			0.45		
10	1.04	2.34			1.30			0.84	0.14			0.60		
11	N.A.	1.09			1.47			1.10	0.13			0.50		
12	1.03	1.13			0.10			0.10	0.15			0.15		
13	1.19	1.34			0.15			0.16	0.26			0.25		
14	1.02	1.22			0.20			0.56	0.61			0.25		
15	1.41	1.54			0.13			0.40	0.42			0.15		

TABLE 3.2: JULY /1985 (cont'd) PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION Cl_2 Dem.	Cl_2 Dos.	NH_3	SO_2	RESIDUAL CL_2 Free	Comb.	Total	POST-CHLORINATION Cl_2 Dem.	Cl_2 Dos.	NH_3	SO_2	RESIDUAL CL_2 Free	Comb.	Total
16	1.25	1.40			0.15			0.29	0.29			0.15		
17	1.61	1.76			0.15			0.34	0.44			0.25		
18	1.36	1.47			0.11			0.12	0.26			0.25		
19	1.28	1.45			0.17			0.39	0.57			0.35		
20	1.11	1.34			0.23			0.25	0.42			0.40		
21	0.83	1.06			0.23			0.25	0.42			0.40		
22	1.26	1.51			0.25			0.25	0.40			0.40		
23	0.95	1.06			0.11			0.20	0.49			0.40		
24	0.38	1.21			0.23			0.25	0.44			0.42		
25	0.94	1.19			0.25			0.33	0.43			0.35		
26	1.20	1.39			0.19			0.77	0.91			0.33		
27	1.32	1.41			0.09			0.00	0.20			0.35		
28	1.24	1.39			0.15			0.61	0.70			0.24		
29	0.60	0.77			0.16			0.87	0.91			0.20		
30	1.30	1.43			0.13			0.65	0.71			0.19		
31	1.56	1.86			0.30			0.80	0.65			0.15		

TABLE 3.2: DISINFECTION PROFILE (JULY 1985)

MOE WPOS PROTOCOL

PORT DOVER
DOAN'S HOLLOW INFILTRATION GALLERY

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
1								*	*			*		
2								*	*			*		
3								*	*			*		
4								*	*			*		
5								*	*			*		
6								*	*			*		
7								*	*			*		
8								*	*			*		
9								2.10	2.70			0.60		
10								0.46	1.66			1.20		
11								0.97	1.87			0.90		
12								0.56	1.46			0.90		
13								1.18	2.08			0.90		
14								1.18	2.08			0.90		
15								1.43	2.08			0.65		

* PLANT NOT IN OPERATION

TABLE 3.2: JULY 1985 (cont'd) DOAN'S HOLLOW INFILTRATION GALLERY - PORT DOVER

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
16								0.96	1.66			0.70		
17								0.35	1.25			0.90		
18								1.18	2.08			0.90		
19								0.66	1.66			1.00		
20								0.81	1.66			0.85		
21								1.23	2.08			0.85		
22								1.28	2.08			0.80		
23								1.23	2.08			0.85		
24								0.46	1.25			0.79		
25								1.13	2.08			0.95		
26								1.11	1.66			0.55		
27								0.81	1.66			0.85		
28								0.56	1.46			0.90		
29								0.04	1.04			1.00		
30								1.49	2.49			1.00		
31								0.00	1:40			1.40		

TABLE 3.2: DISINFECTION PROFILE (OCTOBER/1985)

MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
1	0.96	1.63			0.67			0.14	0.42			0.95		
2	1.17	1.81			0.64			0.43	0.44			0.65		
3	0.87	1.49			0.62			0.40	0.43			0.65		
4	1.59	1.94			0.35			0.18	0.53			0.70		
5	1.47	1.82			0.35			0.37	0.47			0.45		
6	1.18	1.60			0.42			0.00	0.44			0.90		
7	1.02	1.84			0.82			0.22	0.30			0.90		
8	0.51	1.21			0.70			0.25	0.45			0.90		
9	0.99	1.48			0.47			0.14	0.27			0.60		
10	0.96	1.45			0.49			0.19	0.30			0.60		
11	0.97	1.49			0.52			0.23	0.31			0.60		
12	1.17	1.60			0.43			0.30	0.42			0.55		
13	1.55	1.76			0.21			0.15	0.34			0.40		
14	0.88	1.31			0.43			0.21	0.28			0.50		
15	1.21	1.65			0.44			0.13	0.29			0.60		

TABLE 3.2: OCTOBER/1985 (cont'd) PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
16	1.38	1.84			0.46			0.21	0.30			0.55		
17	1.12	1.59			0.47			0.20	0.43			0.60		
18	1.04	1.49			0.45			0.50	0.55			0.50		
19	1.30	1.70			0.40			0.38	0.46			0.48		
20	1.32	1.73			0.41			0.23	0.40			0.58		
21	1.76	1.99			0.23			0.34	0.31			0.20		
22	1.34	1.95			0.61			0.24	0.15			0.52		
23	1.28	1.88			0.60			0.29	0.29			0.60		
24	1.57	1.93			0.36			0.10	0.29			0.55		
25	1.20	1.84			0.64			0.24	0.15			0.55		
26	0.98	1.54			0.56			0.30	0.34			0.60		
27	1.61	2.11			0.50			0.46	0.51			0.55		
28	1.27	1.97			0.70			0.20	0.30			0.80		
29	0.88	1.65			0.77			0.21	0.29			0.85		
30	1.27	1.69			0.42			0.08	0.31			0.65		
31	1.23	1.69			0.46			0.19	0.33			0.60		

TABLE 3.2: DISINFECTION PROFILE (OCTOBER 1985)

MOE WPOS PROTOCOL

PORT DOVER
DOAN'S HOLLOW INFILTRATION GALLERY

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														

* NO INFORMATION AVAILABLE

TABLE 3.2: OCTOBER 1985 (cont'd) DOAN'S HOLLOW INFILTRATION GALLERY - PORT DOVER

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														

1986

DISINFECTION PROFILE
(JANUARY, MAY, JULY, OCTOBER)

TABLE 3.2

TABLE 3.2: DISINFECTION PROFILE (JANUARY/1986)

MOE WPOS PROTOCOL

PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
1	0.74	1.27			0.53			0.11	0.18			0.60		
2	0.38	0.98			0.60			0.35	0.30			0.55		
3	0.80	1.40			0.60			0.34	0.29			0.55		
4	0.90	1.40			0.50			0.12	0.17			0.55		
5	0.88	1.34			0.46			0.11	0.15			0.50		
6	0.84	1.30			0.46			0.26	0.30			0.50		
7	0.84	1.34			0.50			0.26	0.31			0.55		
8	0.92	1.29			0.37			0.04	0.27			0.60		
9	0.80	1.34			0.54			0.25	0.16			0.45		
10	0.66	1.19			0.53			0.05	0.17			0.65		
11	0.75	1.31			0.56			0.00	0.18			0.80		
12	0.88	1.31			0.43			0.12	0.34			0.65		
13	0.90	1.28			0.38			0.08	0.15			0.45		
14	0.78	1.27			0.49			0.09	0.14			0.54		
15	1.00	1.29			0.29			0.09	0.32			0.52		

TABLE 3.2: JANUARY/1986 (cont'd) PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
16	0.88	1.26			0.38			0.09	0.31			0.60		
17	0.84	1.23			0.39			0.23	0.29			0.45		
18	0.89	1.24			0.35			0.02	0.17			0.50		
19	1.84	1.90			0.06			0.05	0.14			0.15		
20	1.54	2.00			0.46			0.34	0.43			0.55		
21	0.74	1.59			0.85			0.04	0.29			1.10		
22	0.88	1.59			0.71			0.27	0.31			0.75		
23	0.19	1.26			1.07			0.37	0.30			1.00		
24	0.31	1.26			0.95			0.46	0.16			0.65		
25	0.50	1.31			0.81			0.22	0.16			0.75		
26	0.46	1.17			0.71			0.24	0.29			0.75		
27	0.67	1.32			0.65			0.07	0.14			0.70		
28	0.91	1.37			0.46			0.02	0.14			0.58		
29	0.47	1.18			0.71			0.06	0.15			0.80		
30	1.30	1.57			0.27			0.25	0.33			0.35		
31	0.79	1.43			0.64			0.28	0.32			0.68		

TABLE 3.2: DISINFECTION PROFILE (JAN./1986)

MOE WPOS PROTOCOL DOAN'S HOLLOW INFILTRATION GALLERY

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														

Plant not in operation - information not available

TABLE 3.2: JAN./1986 (cont'd) DOAN'S HOLLOW INFILTRATION GALLERY

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														

TABLE 3.2: DISINFECTION PROFILE (MAY/1986)

MOE WPOS PROTOCOL PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
1	1.17	1.56			0.39			0.23	0.44			0.60		
2	1.01	1.44			0.43			0.39	0.47			0.51		
3	1.06	1.51			0.45			0.24	0.51			0.72		
4	0.92	1.34			0.42			0.00	0.14			0.59		
5	0.88	1.48			0.60			0.29	0.39			0.70		
6	1.08	1.43			0.35			0.16	0.41			0.60		
7	0.80	1.42			0.62			0.60	0.58			0.60		
8	0.78	1.45			0.67			0.28	0.41			0.80		
9	0.85	1.47			0.62			0.24	0.42			0.80		
10	0.80	1.42			0.62			0.31	0.39			0.70		
11	0.78	1.36			0.58			0.22	0.49			0.85		
12	0.86	1.49			0.63			0.51	0.49			0.61		
13	0.80	1.38			0.58			0.47	0.48			0.59		
14	0.95	1.55			0.60			0.45	0.44			0.59		
15	0.76	1.30			0.54			0.25	0.40			0.69		

TABLE 3.2: MAY/1986 (cont'd)

PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
16	1.35	1.63			0.28			0.38	0.51			0.41		
17	1.01	1.65			0.64			0.65	0.66			0.65		
18	1.23	1.74			0.51			0.69	0.68			0.50		
19	1.44	1.82			0.38			0.55	0.77			0.50		
20	0.96	1.50			0.54			0.69	0.70			0.55		
21	1.15	1.78			0.63			0.49	0.36			0.50		
22	0.83	1.48			0.65			0.81	0.76			0.60		
23	1.03	1.39			0.36			0.43	0.55			0.48		
24	1.42	1.89			0.47			0.34	0.47			0.60		
25	1.28	1.73			0.45			1.23	1.13			0.55		
26	1.45	1.74			0.29			0.27	0.48			0.50		
27	1.23	1.61			0.38			0.49	0.50			0.39		
28	1.36	1.96			0.60			0.43	0.53			0.70		
29	1.42	1.88			0.46			0.32	0.23			0.37		
30	1.44	1.77			0.33			0.59	0.58			0.32		
31	1.58	1.91			0.33			0.63	0.69			0.39		

TABLE 3.2: DISINFECTION PROFILE (MAY/1986)

MOE WPOS PROTOCOL DOAN'S HOLLOW INFILTRATION GALLERY

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
1								*	*			*		
2								*	*			*		
3								*	*			*		
4								*	*			*		
5								*	*			*		
6								*	*			*		
7								*	*			*		
8								*	*			*		
9								*	*			*		
10								*	*			*		
11								*	*			*		
12								*	*			*		
13								*	*			*		
14								*	*			*		
15								0.13	1.04			0.91		

* Plant not in operation - System switched to liquid chlorine.

TABLE 3.2: MAY/1986 (cont'd) DOAN'S HOLLOW INFILTRATION GALLERY

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
16								0.86	1.62			0.76		
17								0.59	1.41			0.82		
18								0.38	1.48			1.10		
19								0.95	1.69			0.74		
20								1.27	2.16			0.89		
21								*	*			*		
22								0.72	1.67			0.95		
23								1.11	1.86			0.75		
24								0.56	1.66			1.10		
25								1.08	1.98			0.90		
26								0.66	1.86			1.20		
27								0.47	1.47			1.00		
28								0.91	1.86			0.95		
29								0.48	1.69			1.21		
30								0.14	1.34			1.20		
31								1.19	2.14			0.95		

* Plant not in operation

TABLE 3.2: DISINFECTION PROFILE (JULY/1986)

MOE WPOS PROTOCOL

PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION Cl_2 Dem.	PRE-CHLORINATION Cl_2 Dos.	PRE-CHLORINATION NH_3	PRE-CHLORINATION SO_2	PRE-CHLORINATION RESIDUAL CL_2 Free	PRE-CHLORINATION RESIDUAL CL_2 Comb.	PRE-CHLORINATION RESIDUAL CL_2 Total	POST-CHLORINATION Cl_2 Dem.	POST-CHLORINATION Cl_2 Dos.	POST-CHLORINATION NH_3	POST-CHLORINATION SO_2	POST-CHLORINATION RESIDUAL CL_2 Free	POST-CHLORINATION RESIDUAL CL_2 Comb.	POST-CHLORINATION RESIDUAL CL_2 Total
1		1.30			0.36			0.31	0.45			0.50		
2		1.71			0.32			0.56	0.59			0.35		
3		1.68			0.36			0.37	0.51			0.50		
4		1.92			0.40			0.33	0.38			0.45		
5		1.59			0.30			0.46	0.48			0.32		
6		1.84			0.21			0.58	0.67			0.30		
7		1.86			0.05			0.28	0.51			0.28		
8		1.87			0.04			0.48	0.74			0.30		
9		2.17			0.24			0.70	0.73			0.27		
10		1.78			0.20			0.47	0.72			0.45		
11		1.94			0.32			0.50	0.70			0.52		
12		2.17			0.29			0.53	0.79			0.55		
13		1.75			0.34			0.28	0.52			0.58		
14		1.79			0.30			0.31	0.46			0.45		
15		1.66			0.33			0.28	0.55			0.60		

TABLE 3.2: JULY/1986 (cont'd)

PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION Cl_2 Dem.	PRE Cl_2 Dos.	PRE NH_3	PRE SO_2	PRE RESIDUAL CL_2 Free	PRE RESIDUAL CL_2 Comb.	PRE RESIDUAL CL_2 Total	POST-CHLORINATION Cl_2 Dem.	POST Cl_2 Dos.	POST NH_3	POST SO_2	POST RESIDUAL CL_2 Free	POST RESIDUAL CL_2 Comb.	POST RESIDUAL CL_2 Total
16	1.46	1.82			0.36			0.73	0.72			0.35		
17	1.53	1.73			0.20			0.55	0.77			0.42		
18	1.33	1.54			0.21			0.36	0.55			0.40		
19	1.26	1.52			0.26			0.67	0.86			0.45		
20	1.53	1.81			0.28			0.80	0.82			0.30		
21	1.05	1.60			0.55			1.07	1.10			0.58		
22	1.39	1.65			0.26			1.00	1.19			0.45		
23	1.56	1.87			0.31			0.68	0.90			0.53		
24	1.37	1.69			0.32			0.35	0.53			0.50		
25	1.16	1.40			0.24			0.30	0.46			0.40		
26	1.36	1.57			0.21			0.19	0.37			0.35		
27	1.19	1.52			0.33			*	0.57			*		
28	1.34	1.37			0.04			0.68	0.86			0.22		
29	0.42	1.17			0.75			1.07	0.97			0.65		
30	1.09	1.40			0.32			0.50	0.67			0.49		
31	1.41	1.70			0.29			0.60	0.61			0.30		

* Data not recorded.

TABLE 3.2: DISINFECTION PROFILE (JULY/1986)

MOE WPOS PROTOCOL DOAN'S HOLLOW INFILTRATION GALLERY

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
1								*	*			*		
2								*	*			*		
3								0.80	1.95			1.15		
4								0.67	1.87			1.20		
5								0.82	1.94			1.12		
6								0.76	1.88			1.12		
7								1.04	1.94			0.90		
8								1.06	1.86			0.80		
9								0.90	1.95			1.05		
10								0.81	2.01			1.20		
11								0.74	1.95			1.21		
12								0.79	1.99			1.20		
13								*	*			*		
14								*	*			*		
15								*	*			*		

*-Plant not in operation

TABLE 3.2: JULY/1986 (cont'd) DOAN'S HOLLOW INFILTRATION GALLERY

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
16								*	*			*		
17								*	*			*		
18								*	*			*		
19								*	*			*		
20								*	*			*		
21								*	*			*		
22								*	*			*		
23								*	*			*		
24								*	*			*		
25								*	*			*		
26								*	*			*		
27								*	*			*		
28								*	*			*		
29								*	*			*		
30								1.83	1.88			0.05		
31								1.00	1.98			0.98		

TABLE 3.2: DISINFECTION PROFILE (OCTOBER/1986)

MOE WPOS PROTOCOL

PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
1	1.10	1.73			0.63			0.54	0.43			0.52		
2	1.29	1.63			0.34			0.23	0.43			0.54		
3	1.01	1.53			0.52			0.53	0.19			0.18		
4	1.58	1.66			0.09			0.38	0.49			0.20		
5	1.76	1.85			0.09			0.87	0.99			0.21		
6	1.36	1.80			0.44			0.42	0.88			0.90		
7	0.98	1.75			0.77			0.92	1.05			0.90		
8	1.19	1.64			0.45			0.58	0.75			0.62		
9	1.46	2.01			0.55			0.56	0.81			0.80		
10	0.67	1.49			0.82			0.42	0.50			0.90		
11	1.39	1.91			0.52			0.65	0.58			0.45		
12	0.56	1.71			1.16			0.84	0.33			0.65		
13	1.03	1.67			0.64			0.66	0.72			0.70		
14	1.09	1.75			0.66			0.70	0.74			0.70		
15	0.39	1.81			0.71			0.46	0.55			0.80		

TABLE 3.2: OCTOBER/1986 (cont'd) PORT DOVER WATER TREATMENT PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
16	1.21	1.64			0.43			0.24	0.51			0.70		
17	1.15	1.70			0.55			0.73	0.90			0.72		
18	1.92	2.31			0.39			0.63	0.94			0.70		
19	0.40	0.84			0.44			0.43	0.59			0.60		
20	1.12	1.49			0.37			0.23	0.66			0.80		
21	1.02	1.48			0.46			0.50	0.48			0.44		
22	1.15	1.51			0.36			0.37	0.49			0.50		
23	1.21	1.71			0.50			0.69	0.69			0.50		
24	1.30	1.69			0.39			0.40	0.51			0.50		
25	1.04	1.25			0.21			0.00	0.29			0.62		
26	1.18	1.54			0.36			0.13	0.46			0.69		
27	1.00	1.42			0.42			0.24	0.44			0.62		
28	1.22	1.69			0.47			0.10	0.25			0.62		
29	1.29	1.74			0.45			0.58	0.53			0.40		
30	1.38	1.83			0.45			0.40	0.50			0.55		
31	1.02	1.51			0.49			0.24	0.32			0.57		

TABLE 3.2: DISINFECTION PROFILE (OCTOBER 1986)

MOE WPOS PROTOCOL DOAN'S HOLLOW INFILTRATION GALLERY

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2	RESIDUAL CL_2			Cl_2		NH_3	SO_2	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb.	Total	Dem.	Dos.			Free	Comb.	Total
1								1.10	2.20			1.10		
2								0.94	2.19			1.25		
3								1.03	2.28			1.25		
4								*	*			*		
5								*	*			*		
6								*	*			*		
7								*	*			*		
8								*	*			*		
9								1.18	2.18			1.00		
10								1.06	2.26			1.20		
11								0.85	2.35			1.50		
12								0.63	2.13			1.50		
13								0.44	1.94			1.50		
14								0.82	1.82			1.00		
15								0.62	1.82			1.20		

* PLANT NOT IN OPERATION.

TABLE 3.2: OCT. 1986 (cont'd) DOAN'S HOLLOW INFILTRATION GALLERY

DATE	PRE-CHLORINATION Cl_2 Dem.	PRE-CHLORINATION Cl_2 Dos.	PRE-CHLORINATION NH_3	PRE-CHLORINATION SO_2	PRE-CHLORINATION RESIDUAL CL_2 Free	PRE-CHLORINATION RESIDUAL CL_2 Comb.	PRE-CHLORINATION RESIDUAL CL_2 Total	POST-CHLORINATION Cl_2 Dem.	POST-CHLORINATION Cl_2 Dos.	POST-CHLORINATION NH_3	POST-CHLORINATION SO_2	POST-CHLORINATION RESIDUAL CL_2 Free	POST-CHLORINATION RESIDUAL CL_2 Comb.	POST-CHLORINATION RESIDUAL CL_2 Total
16								0.77	1.82			1.05		
17								0.29	1.49			1.20		
18								0.63	1.43			0.80		
19								0.63	1.53			0.90		
20								0.82	1.52			0.70		
21								0.95	1.51			0.56		
22								0.86	1.65			0.79		
23								0.73	1.63			0.90		
24								0.56	1.76			1.20		
25								0.63	1.61			0.98		
26								0.48	1.58			1.10		
27								0.43	1.63			1.20		
28								0.90	1.65			0.75		
29								0.78	1.68			0.90		
30								0.92	1.62			0.70		
31								1.28	2.08			0.80		

1983

WATER QUALITY (18 Pages)

TABLE 5.0

NOTE:

1) The information contained in Table 5.0 and 5.1 is based on the Ministry of the Environment Laboratory Tests except for:

i) field chlorine (free) mg/L

ii) field turbidity FTU

iii) field temperature

2) The above exceptions are on-site test results performed by operations staff.

3) A complete set of analyses tables are provided for 1983 information. For subsequent years the tables are provided for only those parameters that have results reported.

TABLE 5.0

WPOS

PLANT Port Dover WATER QUALITY - 1-YEAR SUMMARY ( )

GENERAL CHEMISTRY		1983 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
GENERAL CHEMISTRY															
ALKALINITY	R	103.4			101.4			101.0				105.6		0.2	
mg/L	T	34.8			97.4			99.6				104.6		mg/L	
AMMONIUM TOTAL	R													0.05	
mg/L	T													mg/L	
CALCIUM	R													0.1	
mg/L	T													mg/L	
CHLORIDE	R	16.2			19.2			23.4				21.4		0.2	250
mg/L	T	19.0			18.0			24.0				23.4		mg/L	mg/L
COLOUR TCU	R	7.8			13.0			4.5				10.4		0.5	5
	T	<.4			.7<T			1.5				3.7		TCU	TCU
CONDUCTIVITY	R	205			303			303				306		0.01	
umho/cm	T	303			305			305				315		UMHO/CM	
FIELD CHLORINE (COMBINED)	R													0.1	
mg/L	T													mg/L	
FIELD CHLORINE (FREE)	R													0.1	
mg/L	T													mg/L	
FIELD CHLORINE (TOTAL)	R													0.1	
mg/L	T													mg/L	
FIELD PH	R													0.2	
	T														

WPOS

PLANT Port Dover WATER QUALITY - 1-YEAR SUMMARY ( )

GENERAL CHEMISTRY (Cont'd)		19 83 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
FIELD TEMPERATURE	R														
°C	T														
FIELD TURBIDITY	R														1 FTU
FTU	T														
FLUORIDE	R													0.01	2.4
mg/L	T													mg/L	mg/L
HARDNESS	R	133			103.7			129.8				133.2		0.5	
mg/L	T	132			106.5			128.1				133.2		mg/L	
MAGNESIUM	R													0.05	
mg/L	T													mg/L	c
NITRATE	R													0.05	10 mg/L
mg/L	T													mg/L	as N
NITRITE	R													0.005	1 mg/L
mg/L	T													mg/L	as N
NITROGEN TOTAL KJELDAHL	R													0.1	0.15
mg/L	T													mg/L	mg/L *
PH	R	8.24			8.15			8.15				8.12			
	T	8.21			8.02			8.18				8.15			
PHOSPHORUS FILTERED REACTIVE	R													0.01	
mg/L	T													mg/L	

WPOS

PLANT Port Dover WATER QUALITY - 1-YEAR SUMMARY ( )

GENERAL CHEMISTRY (Cont'd)		19 __ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	OWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
PHOSPHORUS TOTAL	R													0.01	
mg/L	T													mg/L	
SODIUM	R													0.1	
mg/L	T													mg/L	
TOTAL SOLIDS	R													1	
mg/L	T													mg/L	
TURBIDITY	R	24.0			8.7			5.50				8.00		0.01	1
FTU	T	0.28			0.57			0.48				1.20		FTU	FTU
METALS															
ALUMINUM	R													0.003	
mg/L	T													mg/L	
ARSENIC	R													0.001	0.05
mg/L	T													mg/L	mg/L
BARIUM	R													0.001	1
mg/L	T													mg/L	mg/L
BERYLLIUM	R													0.001	
mg/L	T													mg/L	
BORON	R													0.02	5
mg/L	T													mg/L	mg/L
CADMIUM	R													0.0003	0.005
mg/L	T													mg/L	mg/L

WPOS

PLANT ______________ WATER QUALITY - 1-YEAR SUMMARY (   )

METALS (Cont'd)			19 __ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
CHROMIUM	mg/L	R T													0.001 mg/L	0.05 mg/L
COBALT	mg/L	R T													0.001 mg/L	
COPPER	mg/L	R T													0.001 mg/L	1 mg/L
CYANIDE	mg/L	R T													0.001 mg/L	0.2 mg/L
IRON	mg/L	R T													0.002 mg/L	0.3 mg/L c
LEAD	mg/L	R T													0.003 mg/L	0.05 mg/L
MANGANESE	mg/L	R T													0.001 mg/L	0.05 mg/L
MOLYBDENUM	mg/L	R T													0.001 mg/L	
MERCURY	ug/L	R T													0.01 ug/L	1 ug/L
NICKEL	mg/L	R T													0.002 mg/L	

WPOS

PLANT ____________ WATER QUALITY - 1-YEAR SUMMARY (   )

METALS (Cont'd)		19 __ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
SELENIUM	R													0.001	0.01
mg/L	T													mg/L	mg/L
STRONTIUM	R													0.001	
mg/L	T													mg/L	
TIN	R														
(no units available)	T														
URANIUM	R													0.002	.02
mg/L	T													mg/L	mg/L t
VANADIUM	R													0.001	
mg/L	T													mg/L	
ZINC	R													0.001	5
mg/L	T													mg/L	mg/L h
PURGEABLES															
BENZENE	R													1	10
ug/L	T													ug/L	ug/L h
BROMOFORM	R													1	350
ug/L	T													ug/L	ug/L ++
CARBON TETRACHLORIDE	R													1	3
ug/L	T													ug/L	ug/L h
CHLOROBENZENE	R													1	100-300
ug/L	T													ng/L	ng/L h*

PLANT ____________ WATER QUALITY - 1-YEAR SUMMARY (   )

PURGEABLES (Cont'd)		19 ___ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
CHLORODIBROMOMETHANE	R													1	350
ug/L	T													ug/L	ug/L ++
CHLOROFORM	R													1	350
ug/L	T													ug/L	ug/L ++
1,2-DICHLOROBENZENE	R													1	400
ug/L	T													ug/L	ug/L e
1,3-DICHLOROBENZENE	R													1	400
ug/L	T													ug/L	ug/L e
1,4-DICHLOROBENZENE	R													1	400
ug/L	T													ug/L	ug/L e
DICHLOROBROMOMETHANE	R													1	350
ug/L	T													ug/L	ug/L ++
1,1-DICHLOROETHANE	R													1	
ug/L	T													ug/L	
1,2-DICHLOROETHANE	R													1	10
ug/L	T													ug/L	ug/L h
1,1-DICHLOROETHYLENE	R													1	.3
ug/L	T													ug/L	ug/L h
T,1,2-DICHLOROETHYLENE	R													1	
ug/L	T													ug/L	

WPOS

PLANT ______________ WATER QUALITY – 1-YEAR SUMMARY (   )

PURGEABLES (Cont'd)		19 ___ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
DICHLOROMETHANE	R													5	40
ug/L	T													ug/L	ug/L c
1,2 DICHLOROPROPANE	R													1	
ug/L	T													ug/L	
ETHYLBENZENE	R													1	1400
ug/L	T													ug/L	ug/L e
ETHYLENE DIBROMIDE	R														
ug/L	T														
M-XYLENE	R													1	620
ug/L	T													ug/L	ug/L c
O-XYLENE	R													1 ug/L	620
ug/L	T														ug/L c
P-XYLENE	R													1	620
ug/L	T													ug/L	ug/L c
TOLUENE	R													1	100
ug/L	T													ug/L	ug/L c
1,1,2,2-TETRACHLOROETHANE	R													1	1.7
ug/L	T													ug/L	ug/L e
TETRACHLOROETHYLENE	R													1	10
ug/L	T													ug/L	ug/L h

MPOS

PLANT ____________ WATER QUALITY - 1-YEAR SUMMARY (   )

PURGEABLES (Cont'd)		19 __ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
1,1,1-TRICHLOROETHANE	R													1	1000
ug/L	T													ug/L	ug/L c
1,1,2-TRICHLOROETHANE	R													1	6
ug/L	T													ug/L	ug/L e
TRICHLOROETHYLENE	R													1	30
ug/L	T													ug/L	ug/L h
TOTAL TRIHALOMETHANES	R													3	350
ug/L	T													ug/L	ug/L ++
TRIFLUOROCHLOROTOLUENE	R													1	
ug/L	T													ug/L	
<u>ORGANOCHLORINES</u>															
ALDRIN	R													1	700
ng/L	T													ng/L	ng/L **
ALPHA BHC	R													1	700
ng/L	T													ng/L	ng/L c
ALPHA CHLORDANE	R													2	700
ng/L	T													ng/L	ng/L ***
BETA BHC	R													1	300
ng/L	T													ng/L	ng/L c
DIELDRIN	R													2	700
ng/L	T													ng/L	ng/L **

WPOS

PLANT ________ WATER QUALITY - 1-YEAR SUMMARY (   )

ORGANOCHLORINES (Cont'd)		19 __ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	OWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
ENDRIN	R													4	200
ng/L	T													ng/L	ng/L
GAMMA CHLORDANE	R													2	700
ng/L	T													ng/L	ng/L ***
HEPTACHLOR EPOXIDE	R													1	3000 +++
ng/L	T													ng/L	ng/L
HEPTACHLOR	R													1	3000
ng/L	T													ng/L	ng/L +++
HEXACHLOROBENZENE	R													1	10
ng/L	T													ng/L	ng/L h
HEXACHLOROBUTADIENE	R														
ug/L	T														
HEXACHLOROETHANE	R													1	19000
ng/L	T													ng/L	ng/L e
LINDANE	R													1	4000
ng/L	T													ng/L	ng/L
METHOXYCHLOR	R													5	100000
ng/L	T													ng/L	ng/L
MIREX	R													5	
ng/L	T													ng/L	

MPOS

PLANT ______________ WATER QUALITY - 1-YEAR SUMMARY (   )

ORGANOCHLORINES (Cont'd)		19 ___ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
OCTACHLOROSTYRENE	R													1	
ng/L	T													ng/L	
O,P-DDT	R													5	30000
ng/L	T													ng/L	ng/L d
OXYCHLOROANE	R													2	
ng/L	T													ng/L	
PCB TOTAL	R													20	3000
ng/L	T													ng/L	ng/L t
PENTACHLOROBENZENE	R													1	74000
ng/L	T													ng/L	ng/L e
P,P-DDD	R													5	d
ng/L	T													ng/L	
P,P-DDE	R													1	d
ng/L	T													ng/L	
P,P-DDT	R													5	d
ng/L	T													ng/L	
1,2,3,4-TETRACHLOROBENZENE	R													1	
ng/L	T													ng/L	
1,2,3,5-TETRACHLOROBENZENE	R													1	
ng/L	T													ng/L	

MPOS

PLANT ______________ WATER QUALITY - 1-YEAR SUMMARY (   )

ORGANOCHLORINES (Cont'd)		19 ___ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
1,2,4,5-TETRACHLOROBENZENE	R													1	38000
ng/L	T													ng/L	ng/L e
THIODAN I	R													2	74000
ng/L	T													ng/L	ng/L ea
THIODAN II	R													4	74000
ng/L	T													ng/L	ng/L ea
THIODAN SULPHATE	R													4	
ng/L	T													ng/L	
TOXAPHENE	R														
(no units available)	T														
1,2,3-TRICHLOROBENZENE	R													5	10000
ng/L	T													ng/L	ng/L y
1,2,4-TRICHLOROBENZENE	R													5	15000
ng/L	T													ng/L	ng/L y
1,3,5-TRICHLOROBENZENE	R													5	10000
ng/L	T													ng/L	ng/L y
2,3,6-TRICHLOROTOLUENE	R													5	
ng/L	T													ng/L	
2,4,5-TRICHLOROTOLUENE	R													5	10000
ng/L	T													ng/L	ng/L g

MPOS

PLANT ______________ WATER QUALITY - 1-YEAR SUMMARY ( )

ORGANOCHLORINES (Cont'd)		19 __ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
2,6,A-TRICHLOROTOLUENE mg/L	R T													5 ng/L	
TRIAZINES															
ALACHLOR ng/L	R T														
AMETRINE ng/L	R T													50 ng/L	
ATRATONE ng/L	R T														
ATRAZINE ng/L	R T													50 ng/L	46000 ng/L I
BLADEX ng/L	R T													100 ng/L	10000 ng/L I
METOLACHLOR ng/L	R T														
PROMETONE ng/L	R T													50 ng/L	
PROMETRYNE ng/L	R T													50 ng/L	1000 ng/L I
PROPAZINE ng/L	R T													50 ng/L	

WPOS

PLANT ______________ WATER QUALITY – 1-YEAR SUMMARY (   )

TRIAZINES (Cont'd)		19 ___ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
SENCOR	R													100	
ng/L	T													ng/L	
SIMAZINE	R													50	10000
ng/L	T													ng/L	ng/L !
SPECIAL PESTICIDES															
2,4-D	R													100	100000
ng/L	T													ng/L	ng/L
2,4-D BUTYRIC ACID	R													200	18000
ng/L	T													ng/L	ng/L !
DICAMBA	R													100	87000
ng/L	T													ng/L	ng/L !
PENTACHLOROPHENOL	R													50	10000
ng/L	T													ng/L	ng/L h
PICLORAM	R													100	
ng/L	T													ng/L	
2,4-D PROPIONIC ACID	R													100	
ng/L	T													ng/L	
SILVEX	R													50	10000
ng/L	T													ng/L	ng/L
2,4,5-T	R													50	
ng/L	T													ng/L	

SPECIAL PESTICIDES (Cont'd)		19 __ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
2,3,4,5-TETRACHLOROPHENOL	R													50	
ng/L	T													ng/L	
2,3,5,6-TETRACHLOROPHENOL	R													50	
ng/L	T													ng/L	
2,3,4-TRICHLOROPHENOL	R													100	
ng/L	T													ng/L	
2,4,5-TRICHLOROPHENOL	R													50	
ng/L	T													ng/L	
2,4,6-TRICHLOROPHENOL	R													50	10000
ng/L	T													ng/L	ng/L h
ORGANOPHOSPHOROUS PESTICIDES															
DIAZINON	R													50	14000
ng/L	T													ng/L	ng/L
DICHLOROVOS	R														
ng/L	T														
DURSBAN	R														
ng/L	T														
ETHION	R														
ng/L	T														
GUTHION	R														
ng/L	T														

WPOS

PLANT ________________ WATER QUALITY - 1-YEAR SUMMARY (   )

ORGANOPHOSPHOROUS PESTICIDES (Cont'd)		19 ___												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
MALATHION	R														
ng/L	T														
METHYLPARATHION	R													50	7000
ng/L	T													ng/L	ng/L
METHYLTRITHION	R														
ng/L	T														
MEVINPHOS	R														
ng/L	T														
PARATHION	R													50	35000
ng/L	T													ng/L	ng/L
PHORBATE	R														
ng/L	T														
RELDAN	R														
ng/L	T														
RONNEL	R														
ng/L	T														
MASS SPEC.															
DI-N-BUTYL PHTHALATE	R													0.1	34000
ug/L	T													ug/L	ug/L e

WPOS

PLANT ______________ WATER QUALITY - 1-YEAR SUMMARY (   )

MASS SPEC. (Cont'd)		19 ___ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
N-DICHLOROMETHYLENE-PENTACHLOROANALINE ug/L	R													0.1 ug/L	
	T														
DIPHENYL ETHER ug/L	R													0.1 ug/L	
	T														
FLUORANTHENE ug/L	R													0.1 ug/L	
	T														
HEXACHLOROPROPENE ug/L	R													0.1 ug/L	
	T														
METHYL PHENANTHRENE ug/L	R													0.1 ug/L	
	T														
NAPHTHALENE ug/L	R													0.1 ug/L	
	T														
PENTACHLOROBUTADIENE ug/L	R													0.1 ug/L	
	T														
PENTACHLOROPROPANE ug/L	R													0.1 ug/L	
	T														
PENTACHLOROPROPENE ug/L	R													0.1 ug/L	
	T														
PYRENE ug/L	R													0.1 ug/L	
	T														

WPOS

PLANT ______________ WATER QUALITY - 1-YEAR SUMMARY (   )

MASS SPEC. (Cont'd)		19 ___ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
TETRACHLORBUTANE ug/L	R T													0.1 ug/L	
TETRACHLOROBIPHENYL ug/L	R T													0.1 ug/L	
BACTERIA															
RAW WATER:															
TOTAL COLIFORM MF count/100mL	R														
TOTAL COLIFORM BKGD count/mL	R														
FECAL COLIFORM MF count/100mL	R													0	0/0.1 mL
STANDARD PLATE COUNT MF count/100mL	R													0	500
TREATED WATER:															
PRESENT/ABSENT TEST	T														
TOTAL COLIFORM BACKGROUND MF count/100mL	T													0	OWDO Bact I

WPOS

PLANT ______________ WATER QUALITY - 1-YEAR SUMMARY ( )

BACTERIA (Cont'd)		19 ___												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
TREATED WATER: (Cont'd)															
FECAL COLIFORM MF count/100mL	T													0	ODWO Bact I
STANDARD PLATE COUNT MF count/100mL	T														
IF PRESENT/ABSENT TEST POSITIVE:															
COLIFORM P/A	T														
FECAL COLIFORM P/A	T														
E. COLI P/A	T														
AROMONAS P/A	T														
STAPH. AUREUS P/A	T														

Table A - Footnotes

1 = see individual footnotes for Agency of guideline origin

c = California State Department of Health Action Level

d = OWDO for DDT (contains other isomers such as OPDDT and PPDDT)

e = USEPA ambient guideline

ea = United States Environmental Protection Agency (USEPA) ambient level for endosulfan (contains other isomers)

ep = USEPA proposed maximum contaminant level for drinking water

g = suggested Health and Welfare Canada/Ontario Ministry of the Environment guideline value

h = World Health Organization (WHO) guideline

h* = World Health Organization (WHO) Odour Threshold

mg/L = milligrams per litre, parts per million, (ppm)

ng/L = nanograms per litre, parts per trillion, (ppt)

Presence/Absence = microbiological test to indicate presence or absence of coliform bacteria

R = raw water

T = Treated Drinking Water

t = ODWO interim maximum acceptable concentration, (IMAC)

ug/L = micrograms per litre, parts per billion, (ppb)

y = New York State (Taste and Odour) proposed drinking water guideline

++ = total Trihalomethanes

+++ = combined total: Heptachlor and Heptachlor Epoxide

* = if other than OWSP Detection Limit

** = total of Aldrin and Dieldrin

*** = Chlordane is a mixture of alpha and gamma isomers

i = Ministry of the Environment and Health and Welfare Canada, (IMAC)

1984

WATER QUALITY (5 Pages)

TABLE 5.0

TABLE 5.0

WPOS

PLANT Port Dover WATER QUALITY - 1-YEAR SUMMARY ( )

GENERAL CHEMISTRY		19 84 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
GENERAL CHEMISTRY															
ALKALINITY	R	193.2			180.2	144.0			217.2			148.2		0.2	
mg/L	T	190.8			178.6	97.0			194.2			144.6		mg/L	
AMMONIUM TOTAL	R													0.05	
mg/L	T													mg/L	
CALCIUM	R													0.1	
mg/L	T													mg/L	
CHLORIDE	R	20.6			32.0	15.4			19.8			15.8		0.2	250
mg/L	T	25.0			18.2	18.0			8.2			19.2		mg/L	mg/L
COLOUR TCU	R	9.3			5.5	8.5			2.5			6.3		0.5	5
	T	1.5			6.0	1.5			5.5			3.3		TCU	TCU
CONDUCTIVITY	R	413			424	371			470			381		0.01	
umho/cm	T	423			415	300			473			301		UMHO/CM	
FIELD CHLORINE (COMBINED)	R													0.1	
mg/L	T													mg/L	
FIELD CHLORINE (FREE)	R	-	-	-	-	-	-	-	-	-	-	-	-	0.1	
mg/L	T	0.53	0.37	0.54	0.53	0.52	0.48	0.40	0.46	0.58	0.75	0.85	0.66	mg/L	
FIELD CHLORINE (TOTAL)	R													0.1	
mg/L	T													mg/L	
FIELD PH	R													0.2	
	T														

WPOS

PLANT Port Dover WATER QUALITY - 1-YEAR SUMMARY ( )

GENERAL CHEMISTRY (Cont'd)		19 84 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
FIELD TEMPERATURE	R	2.4	2.9	2.3	6.4	9.87	13.87	17.9	22.4	19.30	15.4	8.8	4.0		
°C	T	–	–	–	–	–	–	–	–	–	–	–	–		
FIELD TURBIDITY	R	0.77	1.21	0.72	1.21	1.05	0.66	0.71	0.61	1.60	0.49	0.45	1.31		1 FTU
FTU	T	0.26	0.35	0.27	0.29	0.40	0.33	0.29	0.25	0.24	0.24	0.17	0.17		
FLUORIDE	R					0.13								0.01	2.4
mg/L	T					0.13								mg/L	mg/L
HARDNESS	R	199			195.9	180.5			266.7			194.5		0.5	
mg/L	T	199			194.9	132.5			268.8			200.2		mg/L	
MAGNESIUM	R													0.05	
mg/L	T													mg/L	c
NITRATE	R					0.50								0.05	10 mg/L
mg/L	T					0.30								mg/L	as N
NITRITE	R													0.005	1 mg/L
mg/L	T													mg/L	as N
NITROGEN TOTAL KJELDAHL	R													0.1	0.15
mg/L	T													mg/L	mg/L *
PH	R	8.35			7.52	8.09			7.92			8.27			
	T	8.28			7.92	7.97			7.71			7.93			
PHOSPHORUS FILTERED REACTIVE	R													0.01	
mg/L	T													mg/L	

WPOS

PLANT Port Dover WATER QUALITY - 1-YEAR SUMMARY ( )

GENERAL CHEMISTRY (Cont'd)		19 84 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
PHOSPHORUS TOTAL	R													0.01	
mg/L	T													mg/L	
SODIUM	R					13.6								0.1	
mg/L	T					7.6								mg/L	
TOTAL SOLIDS	R													1	
mg/L	T													mg/L	
TURBIDITY	R	2.35			2.69	11.6			2.75			3.15		0.01	1
FTU	T	0.68			0.82	0.74			1.42			0.68		FTU	FTU
METALS															
ALUMINUM	R					.130								0.003	
mg/L	T					–								mg/L	
ARSENIC	R													0.001	0.05
mg/L	T													mg/L	mg/L
BARIUM	R					0.017								0.001	1
mg/L	T					–								mg/L	mg/L
BERYLLIUM	R					0.00								0.001	
mg/L	T					–								mg/L	
BORON	R													0.02	5
mg/L	T													mg/L	mg/L
CADMIUM	R					<.0003								0.0003	0.005
mg/L	T					–								mg/L	mg/L

WPOS

PLANT Port Dover WATER QUALITY - 1-YEAR SUMMARY ( )

METALS (Cont'd)			1984 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
CHROMIUM		R					.001								0.001	0.05
	mg/L	T					–								mg/L	mg/L
COBALT		R					<.001								0.001	
	mg/L	T					–								mg/L	
COPPER		R					.003								0.001	1
	mg/L	T					–								mg/L	mg/L
CYANIDE		R													0.001	0.2
	mg/L	T													mg/L	mg/L
IRON		R					0.35								0.002	0.3
	mg/L	T					<0.01								mg/L	mg/L c
LEAD	mg/L	R					.003								0.003	0.05
		T					–								mg/L	mg/L
MANGANESE		R					.001								0.001	0.05
	mg/L	T					–								mg/L	mg/L
MOLYBDENUM		R					.001								0.001	
	mg/L	T					–								mg/L	
MERCURY		R					<.001								0.01	1
	ug/L	T					–								ug/L	ug/L
NICKEL		R													0.002	
	mg/L	T													mg/L	

MPOS

PLANT Port Dover WATER QUALITY - 1-YEAR SUMMARY ( )

METALS (Cont'd)		1984 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
SELENIUM	R													0.001	0.01
mg/L	T													mg/L	mg/L
STRONTIUM	R					0.130								0.001	
mg/L	T					-								mg/L	
TIN	R														
(no units available)	T														
URANIUM	R													0.002	.02
mg/L	T													mg/L	mg/L t
VANADIUM	R					.001								0.001	
mg/L	T					-								mg/L	
ZINC	R					.001								0.001	5
mg/L	T					-								mg/L	mg/L h
PURGEABLES															
BENZENE	R													1	10
ug/L	T													ug/L	ug/L h
BROMOFORM	R													1	350
ug/L	T													ug/L	ug/L ++
CARBON TETRACHLORIDE	R													1	3
ug/L	T													ug/L	ug/L h
CHLOROBENZENE	R													1	100-300
ug/L	T													ng/L	ng/L h*

Table A - Footnotes

1 = see individual footnotes for Agency of guideline origin
c = California State Department of Health Action Level
d = OWDO for DDT (contains other isomers such as OPDDT and PPDDT)
e = USEPA ambient guideline
ea = United States Environmental Protection Agency (USEPA) ambient level for endosulfan (contains other isomers)
ep = USEPA proposed maximum contaminant level for drinking water
g = suggested Health and Welfare Canada/Ontario Ministry of the Environment guideline value
h = World Health Organization (WHO) guideline
h* = World Health Organization (WHO) Odour Threshold
mg/L = milligrams per litre, parts per million, (ppm)
ng/L = nanograms per litre, parts per trillion, (ppt)
Presence/Absence = microbiological test to indicate presence or absence of coliform bacteria
R = raw water
T = Treated Drinking Water
t = ODWO interim maximum acceptable concentration, (IMAC)
ug/L = micrograms per litre, parts per billion, (ppb)
y = New York State (Taste and Odour) proposed drinking water guideline
++ = total Trihalomethanes
+++ = combined total: Heptachlor and Heptachlor Epoxide
* = if other than DWSP Detection Limit
** = total of Aldrin and Dieldrin
*** = Chlordane is a mixture of alpha and gamma isomers
! = Ministry of the Environment and Health and Welfare Canada, (IMAC)

1985

WATER QUALITY (3 Pages)

TABLE 5.0

TABLE 5.0

WPOS

PLANT Port Dover WATER QUALITY - 1-YEAR SUMMARY ( )

GENERAL CHEMISTRY		19 85 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	OWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
GENERAL CHEMISTRY															
ALKALINITY	R	105.8				127.6								0.2	
mg/L	T	96.4				97.6								mg/L	
AMMONIUM TOTAL	R													0.05	
mg/L	T													mg/L	
CALCIUM	R													0.1	
mg/L	T													mg/L	
CHLORIDE	R	14.0				14.8								0.2	250
mg/L	T	21.2				15.6								mg/L	mg/L
COLOUR TCU	R	5.0				27.0								0.5	5
	T	3.5				1.5<T								TCU	TCU
CONDUCTIVITY	R	404				297								0.01	
umho/cm	T	415				296								UMHO/CM	
FIELD CHLORINE (COMBINED)	R													0.1	
mg/L	T													mg/L	
FIELD CHLORINE (FREE)	R	-	-	-	-	-	-	-	-	-	-	-	-	0.1	
mg/L	T	0.85	0.67	0.80	0.57	0.65	0.45	0.37	0.44	0.57	0.62	0.31	0.37	mg/L	
FIELD CHLORINE (TOTAL)	R													0.1	
mg/L	T													mg/L	
FIELD PH	R													0.2	
	T														

MPOS

PLANT Port Dover WATER QUALITY - 1-YEAR SUMMARY ( )

GENERAL CHEMISTRY (Cont'd)		19 85 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	OWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
FIELD TEMPERATURE	R	1.3	1.2	2.4	6.2	11.1	13.9	19.4	22.3	21.2	13.9	9.3	2.5		
°C	T	–	–	–	–	–	–	–	–	–	–	–	–		
FIELD TURBIDITY	R	1.71	1.89	N.A.	N.A.	N.A.	N.A.	N.A.	0.97	N.A.	N.A.	N.A.	N.A.		1 FTU
FTU	T	–	–	–	–	–	–	–	–	–	–	–	–		
FLUORIDE	R													0.01	2.4
mg/L	T													mg/L	mg/L
HARDNESS	R	200.3				133.0								0.5	
mg/L	T	202.1				125.0								mg/L	
MAGNESIUM	R													0.05	
mg/L	T													mg/L	c
NITRATE	R													0.05	10 mg/L
mg/L	T													mg/L	as N
NITRITE	R													0.005	1 mg/L
mg/L	T													mg/L	as N
NITROGEN TOTAL KJELDAHL	R													0.1	0.15
mg/L	T													mg/L	mg/L *
PH	R	8.06				8.11									
	T	7.74				8.50									
PHOSPHORUS FILTERED REACTIVE	R													0.01	
mg/L	T													mg/L	

MPOS

PLANT Port Dover WATER QUALITY - 1-YEAR SUMMARY ( )

GENERAL CHEMISTRY (Cont'd)		19 85 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
PHOSPHORUS TOTAL	R													0.01	
mg/L	T													mg/L	
SODIUM	R													0.1	
mg/L	T													mg/L	
TOTAL SOLIDS	R													1	
mg/L	T													mg/L	
TURBIDITY	R	1.09				127.0								0.01	1
FTU	T	0.24				.19<T								FTU	FTU
METALS															
ALUMINUM	R													0.003	
mg/L	T													mg/L	
ARSENIC	R													0.001	0.05
mg/L	T													mg/L	mg/L
BARIUM	R													0.001	1
mg/L	T													mg/L	mg/L
BERYLLIUM	R													0.001	
mg/L	T													mg/L	
BORON	R													0.02	5
mg/L	T													mg/L	mg/L
CADMIUM	R													0.0003	0.005
mg/L	T													mg/L	mg/L

Table A - Footnotes

1 = see individual footnotes for Agency of guideline origin

c = California State Department of Health Action Level

d = OWDO for DDT (contains other isomers such as OPDDT and PPDDT)

e = USEPA ambient guideline

ea = United States Environmental Protection Agency (USEPA) ambient level for endosulfan (contains other isomers)

ep = USEPA proposed maximum contaminant level for drinking water

g = suggested Health and Welfare Canada/Ontario Ministry of the Environment guideline value

h = World Health Organization (WHO) guideline

h* = World Health Organization (WHO) Odour Threshold

mg/L = milligrams per litre, parts per million, (ppm)

ng/L = nanograms per litre, parts per trillion, (ppt)

Presence/Absence = microbiological test to indicate presence or absence of coliform bacteria

R = raw water

T = Treated Drinking Water

t = ODWO Interim maximum acceptable concentration, (IMAC)

ug/L = micrograms per litre, parts per billion, (ppb)

y = New York State (Taste and Odour) proposed drinking water guideline

++ = total Trihalomethanes

+++ = combined total: Heptachlor and Heptachlor Epoxide

* = if other than DWSP Detection Limit

** = total of Aldrin and Dieldrin

*** = Chlordane is a mixture of alpha and gamma isomers

! = Ministry of the Environment and Health and Welfare Canada, (IMAC)

1983 - 1985

WATER QUALITY
YEARLY SUMMARY (5 Pages)

TABLE 5.1

WPOS

PLANT Port Dover WATER QUALITY - 4-YEAR SUMMARY ( )

GENERAL CHEMISTRY		1983			1984			1985			1986			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
GENERAL CHEMISTRY															
ALKALINITY	R	105.6	101.0	102.9	217.2	144.0	176.6	127.6	105.8	116.7				0.2	
mg/L	T	104.6	34.8	84.1	194.2	97.0	161.0	97.6	96.4	97.0				mg/L	
AMMONIUM TOTAL	R													0.05	
mg/L	T													mg/L	
CALCIUM	R													0.1	
mg/L	T													mg/L	
CHLORIDE	R	23.4	16.2	20.1	32.0	15.4	20.7	14.8	14.0	14.4				0.2	250
mg/L	T	24.0	18.0	21.1	25.0	8.2	17.7	21.2	15.6	18.4				mg/L	mg/L
COLOUR TCU	R	13	4.5	8.9	9.3	2.5	6.4	27.0	5.0	16.0				0.5	5
	T	3.7	<.4	1.6	6.0	1.5	3.6	3.5	1.5<T	2.0				TCU	TCU
CONDUCTIVITY	R	306	205	279	470	371	412	404	297	351				0.01	
umho/cm	T	315	303	307	473	300	382	415	296	356				UMHO/CM	
FIELD CHLORINE (COMBINED)	R													0.1	
mg/L	T													mg/L	
FIELD CHLORINE (FREE)	R				1.00	0.00	1.00	1.67	0.06	0.54	1.16	0.04	0.47	0.1	
mg/L	T				1.50	0.50	0.61	2.00	0.10	0:59	1.30	0.05	0.59	mg/L	
FIELD CHLORINE (TOTAL)	R													0.1	
mg/L	T													mg/L	
FIELD PH	R													0.2	
	T														

WPOS

PLANT Port Dover WATER QUALITY - 4-YEAR SUMMARY ( )

GENERAL CHEMISTRY (Cont'd)		1983			1984			1985 **			1986			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
FIELD TEMPERATURE	R				23	1	10.5	24	0	10.4	25	0	9.9		
°C	T				–	–	–	–	–	–	–	–	–		
FIELD TURBIDITY	R				30.1	0.22	0.90	14.0	0.18	1.40	*	*	*		1 FTU
FTU	T				3.40	0.08	0.27	0.75	0.05	0.21	*	*	*		
FLUORIDE	R				–	–	0.13							0.01	2.4
mg/L	T				–	–	0.13							mg/L	mg/L
HARDNESS	R	133.2	103.7	125	266.7	180.5	207.3	200.3	133.0	166.7				0.5	
mg/L	T	133.2	106.5	125	268.8	132.5	199.0	202.1	125.0	163.6				mg/L	
MAGNESIUM	R													0.05	
mg/L	T													mg/L	c
NITRATE	R						0.50							0.05	10 mg/L
mg/L	T						0.30							mg/L	as N
NITRITE	R													0.005	1 mg/L
mg/L	T													mg/L	as N
NITROGEN TOTAL KJELDAHL	R													0.1	0.15
mg/L	T													mg/L	mg/L *
PH	R	8.24	8.12	8.17	8.35	7.52	8.03	8.11	8.06	8.09					
	T	8.21	8.02	8.14	8.28	7.71	8.00	8.50	7.74	8.12					
PHOSPHORUS FILTERED REACTIVE	R													0.01	
mg/L	T													mg/L	

* Turbidity meter out of service
** Turbidity meter out of service for April 1985

MPOS

PLANT Port Dover WATER QUALITY - 4-YEAR SUMMARY ( )

GENERAL CHEMISTRY (Cont'd)		1983 MAX	1983 MIN	1983 AVE	1984 MAX	1984 MIN	1984 AVE	1985 MAX	1985 MIN	1985 AVE	1986 MAX	1986 MIN	1986 AVE	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
PHOSPHORUS TOTAL	R													0.01	
mg/L	T													mg/L	
SODIUM	R						13.6							0.1	
mg/L	T						7.6							mg/L	
TOTAL SOLIDS	R													1	
mg/L	T													mg/L	
TURBIDITY	R	24.0	5.50	11.6	11.6	2.35	4.51	127.0	1.09	64.0				0.01	1
FTU	T	1.20	0.28	0.63	1.42	0.68	0.87	0.24	.19<T	0.22				FTU	FTU
METALS															
ALUMINUM	R						0.13							0.003	
mg/L	T						–							mg/L	
ARSENIC	R													0.001	0.05
mg/L	T													mg/L	mg/L
BARIUM	R						0.017							0.001	1
mg/L	T						–							mg/L	mg/L
BERYLLIUM	R						0.00							0.001	
mg/L	T						–							mg/L	
BORON	R													0.02	5
mg/L	T													mg/L	mg/L
CADMIUM	R						<.0003							0.0003	0.005
mg/L	T													mg/L	mg/L

WPOS

PLANT Port Dover WATER QUALITY - 4-YEAR SUMMARY ( )

METALS (Cont'd)			1983			1984			19__			19__			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
			MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
CHROMIUM		R						.001							0.001	0.05
	mg/L	T						–							mg/L	mg/L
COBALT		R						<.001							0.001	
	mg/L	T						–							mg/L	
COPPER		R						.003							0.001	1
	mg/L	T						–							mg/L	mg/L
CYANIDE		R													0.001	0.2
	mg/L	T													mg/L	mg/L
IRON		R						0.35							0.002	0.3
	mg/L	T						<.01							mg/L	mg/L c
LEAD	mg/L	R						.003							0.003	0.05
		T						–							mg/L	mg/L
MANGANESE		R						.001							0.001	0.05
	mg/L	T						–							mg/L	mg/L
MOLYBDENUM		R						.001							0.001	
	mg/L	T						–							mg/L	
MERCURY		R						<.001							0.01	1
	ug/L	T						–							ug/L	ug/L
NICKEL		R													0.002	
	mg/L	T													mg/L	

WPOS

PLANT Port Dover WATER QUALITY - 4-YEAR SUMMARY ( )

METALS (Cont'd)		19 83 MAX	19 83 MIN	19 83 AVE	19 84 MAX	19 84 MIN	19 84 AVE	19__ MAX	19__ MIN	19__ AVE	19__ MAX	19__ MIN	19__ AVE	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
SELENIUM	R													0.001	0.01
mg/L	T													mg/L	mg/L
STRONTIUM	R					0.130								0.001	
mg/L	T					–								mg/L	
TIN	R														
(no units available)	T														
URANIUM	R													0.002	.02
mg/L	T													mg/L	mg/L t
VANADIUM	R					.001								0.001	
mg/L	T					–								mg/L	
ZINC	R					.001								0.001	5
mg/L	T					–								mg/L	mg/L h
PURGEABLES															
BENZENE	R													1	10
ug/L	T													ug/L	ug/L h
BROMOFORM	R													1	350
ug/L	T													ug/L	ug/L ++
CARBON TETRACHLORIDE	R													1	3
ug/L	T													ug/L	ug/L h
CHLOROBENZENE	R													1	100-300
ug/L	T													ng/L	ng/L h*

1986

BACTERIOLOGICAL TESTING

TABLE 7.0

NOTE:

1) The results in Table 7.0 are based on Ministry of Health - London Office, Laboratory Tests. The raw water results are misleading since water samples were taken from the low lift discharge header after the water had been chlorinated.

TABLE 7.0: BACTERIOLOGICAL TESTING (1986)
MOE WPOS PROTOCOL

PORT DOVER WATER TREATMENT PLANT

		TOTAL COLI				FECAL COLI				FECAL STREP			
		A	B	C	D	A	E	F	G	A	H	I	J
JAN	R		8			8							
	T	8				8							
FEB	R		6			6							
	T	6				6							
MAR	R		6			6							
	T	8				8							
APR	R		10			10							
	T	10				10							
MAY	R	2	6			8							
	T	8				8							
JUN	R		8			8							
	T	8				8							
JUL	R		10			10							
	T	10				10							
AUG	R	2	4	2		8		2					
	T	6	2			10							
SEP	R	6	4			10							
	T	10				10							
OCT	R	2	4	2		6		2					
	T	8				8							
NOV	R	4	4			4	3	1					
	T	8				8							
DEC	R	8				8							
	T	8				8							

NOTE: 1) All results are for 100 mL samples; tests carried out at MOH lab, London, Ont.
2) Values represent number of occurrences.

A = Absent   C = 101-5000   E = 0-10   G = >500   I = 2-50
B = 1-100   D = >5000   F = 11-500   H = 0-1   J = >50

TABLE 7.0: BACTERIOLOGICAL TESTING (1986)

MOE WPOS PROTOCOL

DOAN'S HOLLOW INFILTRATION GALLERY

		TOTAL COLI				FECAL COLI				FECAL STREP			
		A	B	C	D	A	E	F	G	A	H	I	J
JAN	R		4	4		1	3	4					
	T	8				8							
FEB	R		2					2					
	T	2				2							
MAR	R												
	T												
APR	R		4				2	2					
	T	4				4							
MAY	R		5	1		1	5						
	T	3	3			6							
JUN	R		2	2				4					
	T	2	2			4							
JUL	R			2				2					
	T	1	1			2							
AUG	R			8			2	6					
	T	8				8							
SEP	R		7	3			2	8					
	T	10				10							
OCT	R			5			3	3					
	T	6				6							
NOV	R		4	2			2	4					
	T	6				6							
DEC	R		1	3				4					
	T	4				4							

NOTE: 1) All results are for 100 mL samples; tests carried out at MOH lab, London, Ont.
2) Values represent number of occurrences.

A = Absent C = 101-5000 E = 0-10 G = >500 I = 2-50
B = 1-100 D = >5000 F = 11-500 H = 0-1 J = >50

APPENDIX 4

SAMPLE OF DAILY LOGS

APRIL /86

"LOW LIFT PLANT #1"

DATE	FLOW METER READING	TOTAL GALLONAGE	FLOW G.P.M	L.L. PUMP HOURS #1	#2	#3	CHLORINE SET	USED	MG/L	TURBIDITY	PAC SET	USED	MIXED	FEED TIMER	RECIRC SET	CLAR Condition	LAKE TEMP	RESIDUAL COUNT	BACK FLUSH TIMER	SLUDGE BLOW DOWN TIMER	FILTER BACK WASH COUNT
1	64,013,500	733,600	950	12.6	—	12.5	17/18	11	0.20	—	5/10	90 lbs	-	—	2.0	FAIR	43	85	15	20	84
2	64,747,100	566,900	950	10.1	-	10.2	18/19	12	0.10	—	5/10	75	—	—	2.0	GOOD	42°	85	15	20	85
3	65,314,000	481,300	950	8.4	-	8.4	19	7	0.35	-	5/10	61	-	-	2.0	GOOD	44°	85	15	20	86
4	65,795,300	362,500	950	6.0	.5	6.5	19	5	0.30	—	5/10	44	—	—	2.0	GOOD	44°	85	15	20	87
5	66,157,800	416,400	950	7.2	—	7.1	19/20	8	0.15	—	5/10	47	—	—	2.0	GOOD	44°	85	15	20	88
6	66,574,200	480,500	950	7.7	—	7.7	20	7	0.10	—	5/10	59	—	—	2.0	GOOD	44°	85	15	20	89
7	67,054,700	412,900	950	7.8	7.9	—	20	7	0.41	—	5/10	45	—	120	2.0	EXC	44°	89	14	18	90
8	67,467,600	450,000	950	7.4	7.3	—	20	7	0.41	—	5/10	55	—	120	2.0	EXC	44°	89	14	18	91
9	67,917,600	430,700	950	7.6	7.7	—	20	7	0.26	—	5/10	50	—	120	2.0	EXC	45°	91	14	18	92
10	68,348,300	465,400	950	7.9	7.8	—	20	8	0.35	—	5/10	55	—	120	2.0	EXC	46°	90	14	18	93
11	68,813,700	517,800	950	9.1	9.1	—	20	9	0.49	—	5/10	60	—	120	2.0	EXC	46°	90	14	18	94
12	69,331,500	376,600	950	6.2	6.2	—	20	6	0.42	—	5/10	35	—	120	2.0	EXC	41°	90	14	18	95
13	69,708,100	409,400	950	7.4	7.4	—	20	7	0.30	—	5/10	50	—	120	2.0	EXC	41°	90	14	18	96
14	70,117,500	461,000	950	7.8	7.8	—	20	8	0.35	—	5/10	55	—	120	2.0	EXC	41°	90	14	18	97
15	70,578,500	395,600	950	7.2	7.2	—	20	6	.35	—	5/10	30	—	120	2	GREAT	44	90	15	20	98
16	70,974,100	420,900	950	7.7	7.7	—	20	8	.38	—	5/10	30	—	120	2	EXC	48°	90	15	20	99
17	71,394,500	656,500	950	11.8	11.9	—	20	11	.45	—	5/10	45	—	120	2	EXC	43	90	15	20	100
18	72,051,000	585,800	950	10.8	10.7	—	20	10	.30	—	5/10	140	—	120	2	FAIR	44	90	15	20	101
19	72,636,800	567,500	950	10.3	10.3	—	20	10	.45	—	10/10	70	—	120	2	GREAT	42	90	15	20	102
20	73,204,300	593,700	950	11.0	11.0	—	20	11	.30	—	10/10	75	—	120	2	GREAT	46	90	15	20	103
21	73,798,000	617,000	950	11.5	—	11.5	20	11	0.28	—	10/10	80	—	120	2	GREAT	48°	90	14	18	104
22	74,415,000	599,000	950	10.6	—	10.6	21	10	0.35	—	10/10	70	—	120	2	GOOD	46°	90	14	18	105
23	75,004,000	718,000	950	13.4	—	13.4	21	13	0.40	—	10/10	90	—	120	2	GOOD	44°	90	14	18	106
24	75,722,000	724,300	950	13.1	—	13.1	21	13	0.35	—	10/10	80	—	120	2	GOOD	44°	90	14	15	107
25	76,446,300	687,000	950	10.4	—	10.4	21	11	0.25	—	10/10	72	—	120	2	GOOD	44°	90	14	15	108
26	77,033,300	631,100	950	11.5	—	11.4	21	11	0.25	—	10/10	76	—	120	2	GOOD	46°	90	14	15	109
27	77,664,400	641,200	950	11.3	—	11.3	21/22	11	0.15	—	10/10	75	—	120	2	GOOD	47°	90	14	15	110
28	78,305,600	916,100	950	—	16.1	15.1	22	15	0.31	—	5/10	60	—	120	2.0	GOOD	49°	90	15	15	111
29	79,221,700	606,100	950		12.0	12.0	22	13	0.32	—	5/10	35	—	120	2.0	[illegible]	53°	90	15	15	111
30	79,827,800	777,800	950		14.3	13.3	22	14	0.45	—	5/10	20	—	120	1	GOOD	47°	90	15	15	112
31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TOTAL		16,702,100		253.8	167.9	174.5		287				1839	—								

HIGH DAY	916,100
LOW DAY	362,500

BJL (initials)

APP-141

Atm...

Low Lift Plant #2

DATE	HOURS RUN	FLOW G.P.M. 2700	GROSS GALLONAGE	CHLORINE SET	CHLORINE USED	CHLORINE MG/L	TURBIDITY	PAC SET	PAC USED	PAC MIXED	RECIRC SET	CLAR CONDITION	LAKE TEMP	FILTER BACKWASH TIME	FILTER BACKWASH GALLONAGE @ 1800 G.P.M.	NET GALLONAGE
1	11.0	450	297,000	5	3	0.50	–	1.0	3	–	2.0	FAIR	43	20 MIN	36,000	261,000
2	9.3	450	251,100	5	2	0.50	–	1.0	2	–	2.0	GOOD	42°	20 MIN	36,000	215,100
3	8.1	450	218,700	5	2	0.55	–	1.0	1½	–	2.0	GOOD	44°	20 MIN	36,000	182,700
4	6.6	450	178,200	5	1	0.45	–	1.0	1½	–	2.0	GOOD	44°	20 MIN	36,000	142,200
5	7.8	450	210,600	5	3	0.35	–	1.0	2	–	2.0	GOOD	44°	20 MIN	36,000	174,600
6	8.3	450	224,100	5	1	0.35	–	1.0	~~4~~	–	2.0	GOOD	44°	20 MIN	36,000	188,100
7	7.7	450	207,900	5	2	0.58	–	1.0	2	–	2.0	GOOD	44°	15 MIN	27,000	180,900
8	7.3	450	197,100	5	1½	0.38	–	1.0	1½	–	2.0	GOOD	44½°	15 MIN	27,000	170,100
9	7.9	450	213,300	5	1½	0.35	–	1.0	1½	–	2.0	EXC.	45°	20 MIN	36,000	177,300
10	8.7	450	234,900	5	2	0.42	–	1.0	2	–	2.0	EXC	46°	20 MIN	36,000	198,900
11	9.0	450	243,000	5	2	0.49	–	1.0	2	–	2.0	EXC	45°	25 MIN	45,000	198,000
12	6.8	450	183,600	5	2	0.65	–	1.0	1	–	2.0	EXC	41°	20 MIN	36,000	147,600
13	8.5	450	229,500	5	2	0.55	–	1.0	2	–	2.0	EXC	41°	20 MIN	36,000	193,500
14	12.2	450	329,400	5	3	0.60	–	1.0	3	–	2.0	EXC	41°	20 MIN	36,000	293,400
15	8.5	450	229,500	5	3	.35	–	1	1	–	2	GREAT	44	20 MIN.	36,000	193,500
16	8.3	450	224,100	5	1	.48	–	1.0	2	–	2	GOOD	48°	15 MIN	27,000	197,100
17	11.6	450	313,200	5	3	.50	–	1	1½	–	2	EXC.	43	15 MIN	27,000	286,200
18	10.6	450	286,200	5	3	.50	–	1.5	2½	–	1	EXC.	44	15 MIN	27,000	259,200
19	10.5	450	283,500	5	2	.70	–	1.5	2	–	1	GREAT	42	15 MIN	27,000	256,500
20	10.8	450	291,600	5	3	.75	–	1.5	2½	–	1	GREAT	46	15 MIN	27,000	264,600
21	7.3	450	197,100	5	3	0.34	–	1.5	2½	–	1.5	GOOD	48°	20 MIN	36,000	161,100
22	8.6	450	232,200	6	4	0.50	–	1.5	3	–	1.5	GOOD	46°	30 MIN	54,000	178,200
23	12.0	450	324,000	6	4	0.65	–	1.5	2	–	1.5	GOOD	44°	20 MIN	36,000	288,000
24	11.5	450	310,500	6	3	0.55	–	1.5	3	–	1.5	GOOD	44°	20 MIN	36,000	274,500
25	10.2	450	275,400	6	3	0.55	–	1.5	2	–	1.5	GOOD	44°	40 MIN	72,000	203,400
26	10.9	450	294,300	6	3	0.40	–	1.5	3	–	1.5	GOOD	46°	20 MIN	36,000	258,300
27	10.9	450	294,300	6	4	0.40	–	1.5	3	–	1.5	GOOD	47°	20 MIN	36,000	258,300
28	5.1	450	187,700	6	1	0.55	–	1.5	2	–	2.0	GOOD	49°	70 MIN	126,000	61,700
29	11.7	450	315,900	6	4	0.18	–	1.5	2	–	2.0	GOOD	53°	15 MIN	27,000	288,900
30	12.5	450	337,500	6	3	0.80	–	1	1½	–	2.0	GOOD	47°	25 MIN	45,000	292,500
31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TOTAL	280.2	X	7,565,400	X	75	X	X	X	61.5	—	X	X	X	650	1,170,000	6,395,400

HIGH DAY	337,500
LOW DAY	178,200

APP-142

[signature] Ray Powell

HIGH LIFT PLANT #1

APRIL /86

DATE	FLOW METER READING	TOTAL GALLONAGE PUMPED	FLOW RATE G.P.M.	PUMP HOURS #1	PUMP HOURS #2	PUMP HOURS #3	POST CHLORINE SET	POST CHLORINE USED	POST CHLORINE mg/L
1	528,893,800	207,000	1100	2.77	—	.42	6	1	0.25
2	529,100,800	88,200	1100	1.56	—	—	6	1	0.45
3	529,189,000	18,300	1100	.31	—	—	6	1	0.35
4	529,207,300	—	1100	X	—	—	6	1	0.30
5	529,207,300	—	1100	X	—	—	6	2	0.25
6	529,207300	—	1100	X	—	—	6	3	0.40
7	529,207,300	—	1100	—	—	X	6	1	0.50
8	529,207,300	—	1100	—	—	X	6	1	0.50
9	529,207,300	19,900	1100	—	—	.33	6	2	0.42
10	529,225,200	11,200	1100	—	—	.21	6	3	0.45
11	529,236,400	18,500	1100	—	—	.33	6	1	0.50
12	529,254,900	—	1100	—	—	X	6	1	0.65
13	529,254,900	—	1100	—	—	X	6	2	0.59
14	529,254,900	37,300	1100	—	1.16	—	6	1	0.58
15	529 292 200	NIL	1100	—	X	—	6	2	.15
16	529 292 00	400	1100	—	.01	—	6	2	.52
17	529 292 600	126,700	1100	—	3.68	—	6	2	.55
18	529 419 200	110 300	1100	—	3.39	—	6	2	.45
19	529 529 600	67,400	1190	—	2.1	—	6	2	.50
20	529 597 000	131,000	1100	—	4.07	—	6	2	.35
21	529,728,000	141,600	1100	—	4.39	—	6	2	0.49
22	529 869,600	111,300	1100	—	3.22	—	7	2	0.60
23	529,980,900	284,500	1100	—	8.14	—	7	2	0.65
24	530,265,400	267,000	1100	—	7.40	—	7	1	0.50
25	530,532,400	127,000	1100	—	3.67	—	7	1	0.60
26	530,659,400	118,200	1100	—	3.78	—	7	2	0.35
27	530,777,600	201 100	1100	—	6.25	—	7	1	0.40
28	530,978,700	288 100	1100	—	7.72	—	7	2	0.45
29	531,266,800	144,400	1100	—	4.01	—	7	3	0.05
30	531,411,200	211,000	1100	—	5.79	—	8	3	0.61
31	—	—	—	—	—	—	—	—	—
TOTAL	X	2,730,400	X	4.64	68.75		X	52	X

HIGH DAY	288,100
LOW DAY	ZIP.

HIGH LIFT PLANT # 2

APRIL / 86

25,200

DATE	FLOW METER READING	TOTAL GALLONAGE PUMPED	FLOW RATE G.P.M	PUMP HOURS #4	PUMP HOURS #5	POST CHLORINE SET	POST CHLORINE USED	POST CHLORINE MG/L	
1	729128	507,528	420	—	20.14	6	1	0.25	—
2	729675	462,336	420	.54	17.68	6	1	0.45	—
3	730192	437,724	420	—	17.37	6	1	0.35	—
4	730689	352,044	420	—	13.97	6	1	0.30	—
5	731116	378,504	420	—	15.02	6	2	0.25	—
6	731576	424,368	420	—	16.84	6	3	0.40	—
7	732063	434,952	420	—	17.26	6	1	0.50	—
8	732531	410,256	420	—	16.28	6	1	0.50	—
9	733008	388,332	420	—	15.41	6	2	0.42	—
10	733457	419,580	420	—	16.65	6	3	0.45	—
11	733922	465,696	420	—	18.48	6	1	0.50	—
12	734438	347,760	420	—	13.80	6	1	0.65	—
13	734873	409,752	420	—	16.24	6	2	0.59	—
14	735326	435,960	420	—	17.30	6	1	0.58	—
15	735806	403,200	420	—	16.00	6	2	.15	—
16	736270	445,8[illegible]	420	.79	16.73	6	2	.52	—
17	736786	442,960	420	—	19.60	6	2	.55	—
18	737314	455,868	420	—	18.09	6	2	.45	—
19	737828	513,324	420	—	20.37	6	2	.50	—
20	738365	470,988	420	—	18.69	6	2	.35	—
21	738884	471,240	420	—	18.70	6	2	0.40	—
22	739408	478,548	420	—	18.99	7	2.	0.60	—
23	739919	350,280	420	—	13.90	7	2	0.65	—
24	740360	361,872	420	—	14.36	7	1	0.50	—
25	740812	406,980	420	—	16.15	7	1	0.60	—
26	741278	505,008	420	—	20.04	7	2	0.35	—
27	741827	399,924	420	—	15.87	7	1	0.48	—
28	742285	387,576	420	—	15.38	7	2	0.45	—
29	742754	471,744	420	—	18.72	7	3	0.05	—
30	743263	462,600	420	0.93	16.94	8	3	0.61	—
31	—	—	—	—	—	—	—	—	—
TOTAL		12,958,800		2.36	511.17		52		

HIGH DAY	513,324
LOW DAY	347,760

1986

"April" DOAN S HOLLOW PLANT "April"

DATE	TIME	CL2 FEED	CL2 WT.	CL2 USED	CL2 LEFT	CL2 RESIDUAL	TOTAL GALLONAGE [redacted].	HRS. RUN	PUMP PRESS
1	—	—	—	—	—	—	—	—	—
2	7:30 AM	5	180 1/2	4 1/2	87 1/2	1.70	213,800	19	64
3	9:00 AM	4	176	4	83	0.61	268,900	24	63
4	9:00 AM	4	172	3	79	0.70	252,200	24	63
5	7:20 AM	4	169	4	76	0.40	283,500	24	63
6	8:30 AM	4	165	4	72	0.40	270,000	24	63
7	8:25 AM	4	161	5.5	68	0.52	270,300	24	63
8	8:00 AM	4	155.5	1.5	62.5	0.34	277,100	24	63
9	8:00 AM	5	154	4 1/2	61	0.69	286,500	24	67
10	7:50 AM	5	149 1/2	4 1/2	56 1/2	0.85	297,300	24	66
11	8:40 AM	5	145	4	52	0.55	280,900	24	65
12	8:00 AM	4	141	4	48	0.69	291,100	24	66
13	8:20 AM	4	137	3	44	0.80	291,200	24	66
14	8:40 AM	4	134	5	41	0.69	289,500	24	65
15	8:55 AM	4	129	3 1/2	36	.65	274,800	24	65
16	7:50 AM	4	125 1/2	4 1/2	32 1/2	.62	291,200	24	66
17	8:30 AM	4	121		28	0.50			46
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									

APPENDIX 5

SITE VISIT SUMMARY

MUNICIPALITY -	PORT DOVER W.T.P.
PROJECT No. -	7-2009

Inspected by: RON HUNSINGER
JANUSZ BUDZIAKOWSKI
GERRY SIGAL

Date: OCTOBER 16, 1986

W.P.O.S. - PLANT INSPECTION

1. Plant Design Rate: 1642 Igpm
   Plant Rated Capacity:
   Plant Records: AVAILABLE ON SITE.

2. Raw Water Source: LAKE ERIE
   Water Quality Records: AVAILABLE ON SITE

3. Intake: Type: WELDED STEEL
   Location: 1500 FT. INTO LAKE ERIE
   Diameter: 20" Φ STEEL PIPE
   Length: 1500 FT.

   Crib: Type: STEEL
   Size: 20-0" Φ

   Screens: Type: 2 - MANUALLY CLEANED
   Size:

4. Wet Well:
   - Size:
   - Location: TWO (OLD PLANT
   - Type: & NEW PLANT)

5. Low Lift Pumps:
   - Number: NEW – 3 (525 Igpm)
   - Type: OLD – 2 (450 Igpm)
   - Capacity:
   - Flow Metering:

6. Chemical Feed System:
   - Type: PRE Cl_2 INTO BOTH *
   - Feeder: WELLS. (FOR ODOUR
   - Location: & TASTE)
   - Feed Points: POST. Cl_2 – POOR

* CORROSION IN NEW WELL MAY BE DUE TO Cl_2.

DETENTION TIME (DIFFUSED AT SUCTION TO PUMPS)

Type of Chemicals: CHLORINE (2 SYSTEMS
POLY ALUMINUM CHLORIDE.
(COAGULATION).

Hazards:

Problems: CORROSION.

7. Chemical Mixing:
   (a) Flash Mixer:
   - Type: NONE
   - Ret. Time:
   - "G" Value:

   (b) Flocculator:
   - Type: GRAVER
   - Ret. Time: "REACTIVATOR"... 42'–O"
   - "G" Value: (NEW PLA[NT]

8. Settling:

Type:	GRAVER SOLID CONTACT. UN
Capacity:	(POLY PAC ADDED TO INFLUEN
Desludging:	PIPE).
Wastes To:	SANITARY M.H.

9. Filtration:

Design Manual On Site

Type:	3-STEEL GRAVER UNITS
Number:	(NEW)
Capacity:	+ 2 CONCRETE (OLD PLA
Fil. Rate	3 2 Igals/FT^2
Media:	DUAL CAP. 1080 IGP
Underdrain:	GRAVER STAINERS
B.W. Rate:	1695 Igpm.
B.W. Frequency:	
Turb. Monitoring:	
Wastes To:	SETTLING TANK WITH OVERFLOW TO LAKE

NOTE: NO SURFACE WASH
ROOF DRAINS INTO FILTER.

10. Water Storage:

(a) Clearwell:

Type:	UNDERGROUND.
Capacity:	
Size	

(b) Reservoir:

(c) Standpipe or Water Tower:

11. High Lift Pumps:

Number:	3-NEW + 2-OLD
Type:	VERTICAL TURBINE
Capacity:	1560 Igpm.
Flow Metering:	ON TOTAL

12. Laboratory Facilities:

(a) Equipment: LIMITED EQUIPMENT.
JAR TESTER
TURBIDIMETER.

(b) Routine: Tests: JAR TESTS
TURBIDITY (WHEN WORKING)
CHLORINE RESIDUAL
TEMPERATURE
2 TIMES DAILY

13. Maintenance Pgms: CLARIFIER SS. TO CONTROL BLANKET LEVEL

14. Plant Schematic: OF NEW PLANT, AVAILABLE ON SITE.

Plant Drawings:

15. General Comments:

1. PLANT OPERATES ON STOP/START ≈ 6 TIMES DAILY
2. THERE IS ANOTHER SOURCE OF WATER WHICH ADDED TO SYSTEM ≈ 290 - 300 000 gpd.
INFILTRATION GALLERY — ONLY CHLORINATE.
NO CON TIME
BACTI TEST WEEKLY.
PESTICIDES DONE ON OCCASION

POSSIBLE CROSS CONNECTION BETWEEN POND/RESERVOIR.

APPENDIX 6

PHOTOGRAPHIC RECORD OF PLANT FACILITIES

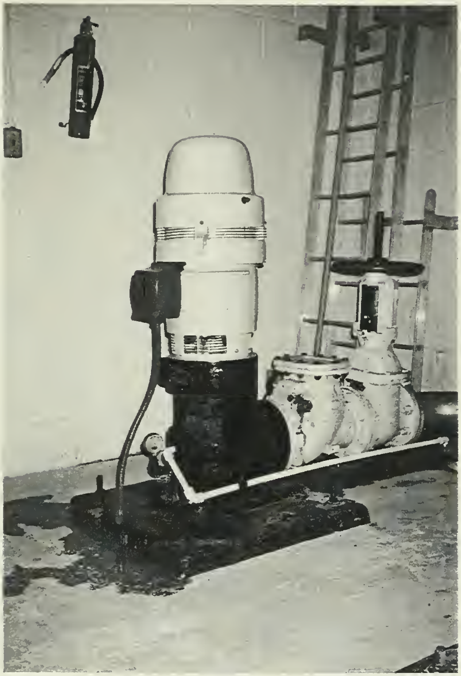
PORT DOVER WATER TREATMENT PLANT

NEW CLARIFIER BUILDING

ORIGINAL PLANT

NEW LOW LIFT PUMPING STATION

NEW PLANT LOW LIFT PUMP #1



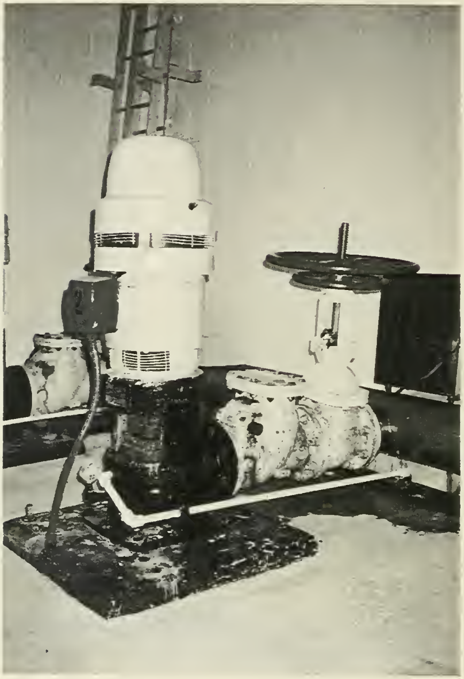
PUMP

MAKE:	WORTHINGTON
SIZE:	10h 75-2
SERIAL NUMBER:	43924
SPEED:	1760 RPM
TDH:	21.8 m (71.5 FT.)
CAPACITY:	3015 m^3/d (583 IGPM)

MOTOR

MAKE:	WESTINGHOUSE
TYPE:	H5B
FRAME:	256 TP
INSUL CLASS:	B
SAFETY FACTOR:	1.15
575 VOLTS 20.6 AMPS	
SPEED:	1750 RPM
SERIAL NUMBER:	2-19S3523

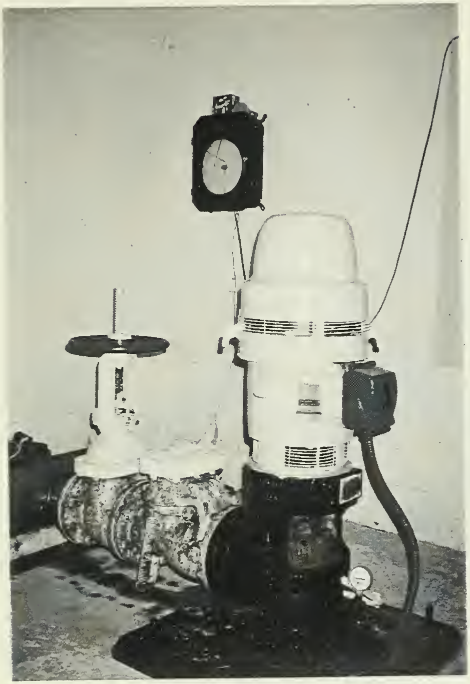
NEW PLANT LOW LIFT PUMP #2



PUMP
MAKE: WORTHINGTON
SIZE: 10H 75-2
SERIAL NUMBER: 43923
SPEED: 1760 RPM
TDH: 21.8m (71.5 FT.)
CAPACITY: 3815 m^3/d (583 IGPM)

MOTOR
MAKE: WESTINGHOUSE
TYPE: H5B
FRAME: 256 TP
INSUL CLASS: B
SAFETY FACTOR: 1.15
575 VOLTS 20.6 AMPS
SPEED: 1750 RPM
SERIAL NUMBER: 1-19S3523

NEW PLANT LOW LIFT PUMP #3



PUMP

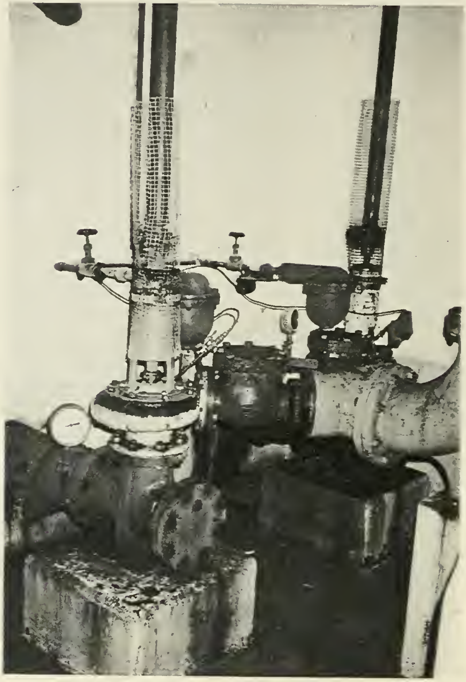
MAKE:	WORTHINGTON
SIZE:	10H 75-3
SERIAL NUMBER:	43922
SPEED:	1750 RPM
TDH:	21.8 m (71.5 FT.)
CAPACITY:	38.5 m^3/d (583 IGPM)

MOTOR

MAKE:	WESTINGHOUSE
TYPE:	H5B
FRAME:	256 TP
INSUL CLASS:	B
SAFETY FACTOR:	1.15
575 VOLTS 20.6	AMPS
SPEED:	1750 RPM
SERIAL NUMBER:	3-19S3523

OLD PLANT LOW LIFT PUMP #4

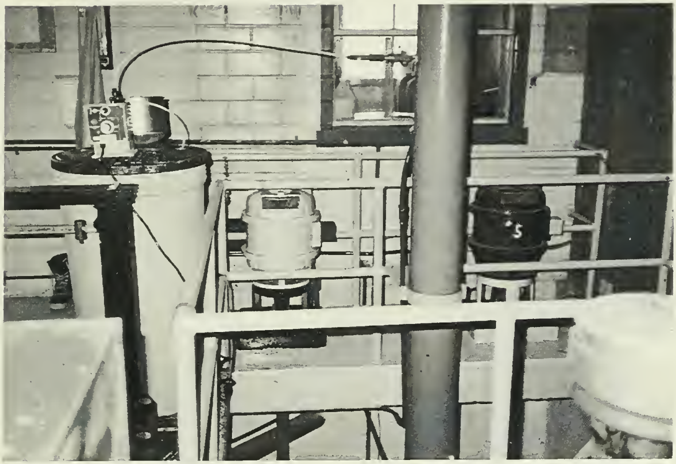
OLD PLANT LOW LIFT PUMP #5



PUMP #4		PUMP #5	
MAKE:	SMART TURNER	MAKE:	SMART TURNER
SIZE:	4L X V.B.E.	SIZE:	4L X V.B.E.
SERIAL NUMBER:	541659	SERIAL NUMBER:	541658
TDH:	9.8 m (32 ft.)	TDH:	9.8 m (32 ft.)
CAPACITY:	2614 m^3/d (400 IGPM)	CAPACITY:	2614 m^3/d (400 IGPM)
SPEED:	1450 RPM	SPEED:	1450 RPM

OLD PLANT LOW LIFT PUMP # 4

OLD PLANT LOW LIFT PUMP # 5

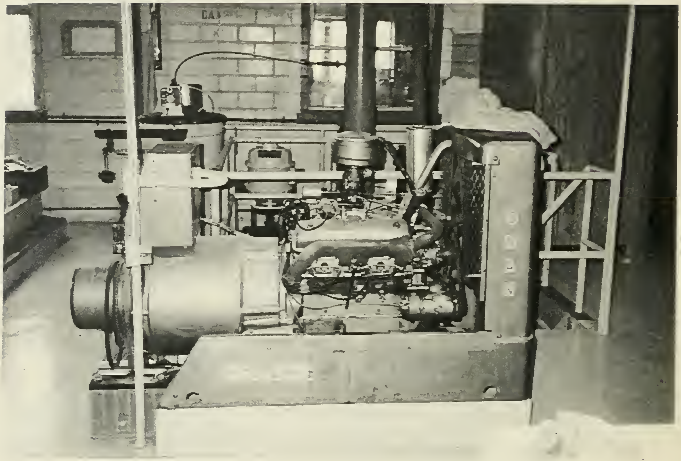


MOTOR

MAKE:	CANADIAN WESTINGHOUSE
TYPE:	HS
SIZE:	7.5 HP
FRAME:	324
SAFETY FACTOR:	1.15
550 VOLTS 3 PHASE 60 CYCLE	
SPEED:	1765 RPM
SERIAL NUMBER:	1-42S466

MOTOR

MAKE:	CANADIAN WESTINGHOUSE
TYPE:	HS
SIZE:	7.5 HP
FRAME:	324
SAFETY FACTOR:	1.15
550 VOLTS 3 PHASE 60 CYCLE	
SPEED:	1765 RPM
SERIAL NUMBER:	2-42S466



SUPPLY: LOW LIFT PUMP #4 AND #5

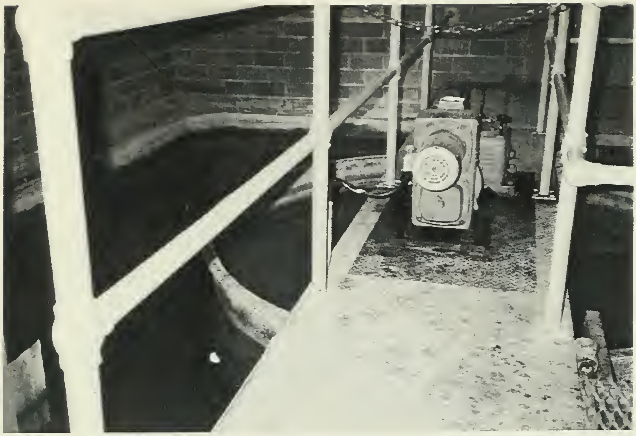
GENERATOR

MAKE: ONAN
MODEL: 35ED-9R8/1G
SERIAL NUMBER: 29B603695
OUTPUT: 35 KW/575 V/43.7 AMPS/3 PHASE/60 CYCLE
GENERATOR: 43.75 KVA

ENGINE

MAKE: FORD
MODEL: B6PJ-6005-A-50-30
TYPE: GAS
SERIAL NUMBER: 8459-E2ICT
HORSEPOWER: 88 HP

CLARIFIERS



OLD PLANT

NEW PLANT

MAKE: GRAVER REACTIVATOR
DESIGN FLOW: 1134 IGPM

FILTER - NEW PLANT - TYPICAL OF THREE

MAKE:	GRAVER
MODEL:	MONOVALUE AUTOMATIC FILTER
SIZE:	3.66 m IN DIAMETER X 4.8 m DEEP.

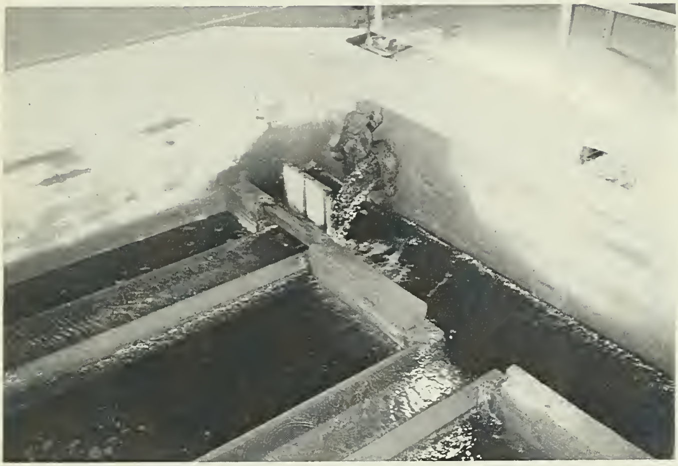
FILTER MEDIA:

TYPE:	GRADED TORPEDO SAND 0.45 - 0.55 MM
VOLUME:	6.6 CUBIC METRES (233 CU. FT.)
MEDIA DEPTH:	610 mm (24 INCHES)

OPERATING DATA:

DESIGN FLOW:	360 IGPM/FILTER
DESIGN FLOW RATE:	3.2 IGPM/SQ. FT.
BACKWASH FLOW:	1695 IGPM
BACKWASH RATE:	15 IGPM/SQ. FT.

FILTER - OLD PLANT - TYPICAL OF TWO

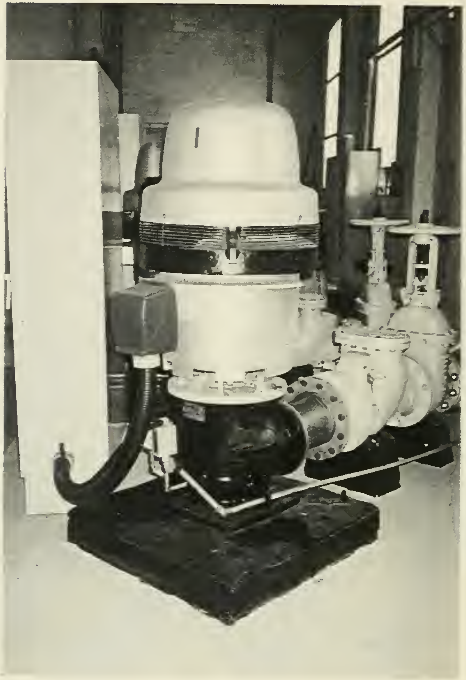


TYPE: RAPID SAND FILTER
DESIGN RATE: NOT AVAILABLE

* FILTER MEDIA:
GRAVEL: 750 MM - 900 mm
SAND: APPROXIMATELY 500 mm
ANTHRAFILT: 175 mm

* AS MEASURED BY PLANT PERSONNEL DECEMBER 1986.

NEW PLANT - HIGH LIFT PUMP #1



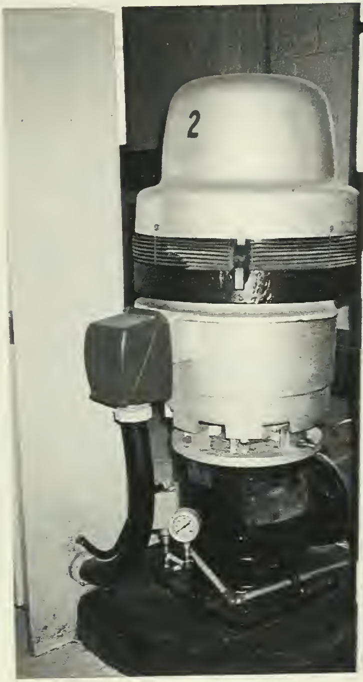
PUMP

MAKE:	WORTHINGTON
TYPE:	VERTICAL TURBINE
SIZE:	14 M-160-3
SERIAL NUMBER:	VTP 43925
CAPACITY:	8500 m^3/D (1300 IGPM)
TDH:	82.2 m (270 FT.)

MOTOR

MAKE:	WESTINGHOUSE
MODEL:	LIFELINE T
TYPE:	HSB
POWER:	575 V/135 A/60 CYCLES/3 PHASE/150 HP
FRAME:	444 TPH
SAFETY FACTOR:	1.15
SPEED:	1770 RPM
SERIAL NUMBER:	1-19S8246

NEW PLANT - HIGH LIFT PUMP #2



PUMP

MAKE:	WORTHINGTON
TYPE:	VERTICAL TURBINE
SIZE:	14 M-160-3
SERIAL NUMBER:	VTP 43927
CAPACITY:	8500 m^3/D (1300 IGPM)
TDH:	82.2 m (270 FT.)

MOTOR

MAKE:	WESTINGHOUSE
MODEL:	LIFELINE T
TYPE:	HSB
POWER:	575 V/135 A/60 CYCLES/3 PHASE/150 HP
FRAME:	444 TPH
SAFETY FACTOR:	1.15
SPEED:	1770 RPM
SERIAL NUMBER:	2-19S8246

NEW PLANT - HIGH LIFT PUMP #3

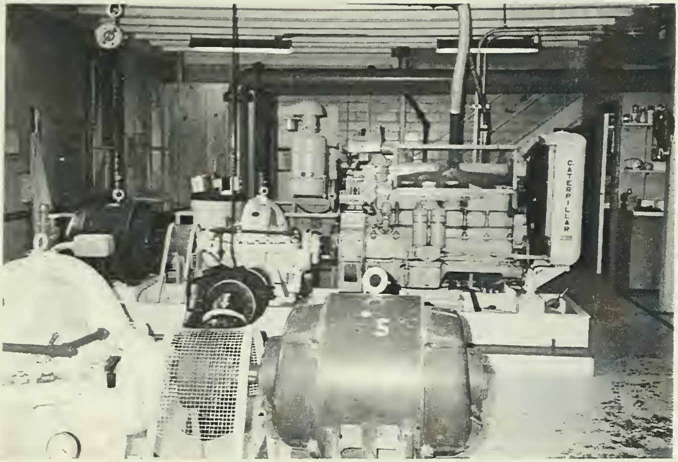
PUMP

MAKE:	WORTHINGTON
TYPE:	VERTICAL TURBINE
SIZE:	14 M-160-3
SERIAL NUMBER:	VTP 43926
CAPACITY:	8500 m^3/D (1300 IGPM)
TDH:	82.2 m (270 FT.)

MOTOR

MAKE:	WESTINGHOUSE
MODEL:	LIFELINE T
TYPE:	HSB
POWER:	575 V/135 A/60 CYCLES/3 PHASE/150 HP
FRAME:	444 TPH
SAFETY FACTOR:	1.15
SPEED:	1770 RPM
SERIAL NUMBER:	3-19S8246

OLD PLANT - HIGH LIFT - PUMP #4



PUMP

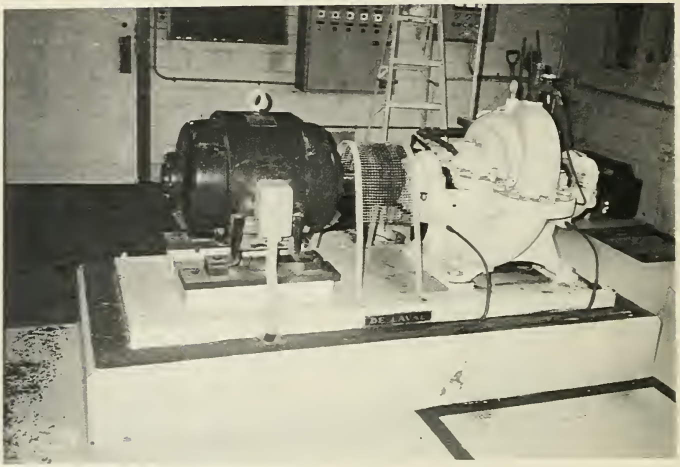
MAKE:	DELAVAL
MODEL:	2K S 514
TYPE:	HORIZONTAL SPLIT CASE
SPEED:	1450 RPM
CAPACITY:	5450 m^3/D (834 IGPM) (1000 USGPM)
TDH:	83.8 m (275 FT.)

MOTOR

MAKE:	CANADIAN GENERAL ELECTRIC
MODEL:	8F1689 -XX INDUCTION
SERIAL NUMBER:	668868
TYPE:	K
FRAME:	504-S
POWER:	550 VOLTS/3 PHASE/60 CYCLES/100 AMPS/100 HP
SPEED:	1770 RPM

DIESEL GENERATOR

MAKE:	CATERPILLAR
MODEL:	D318
POWER:	92 HP
SERIAL NUMBER:	5V14449



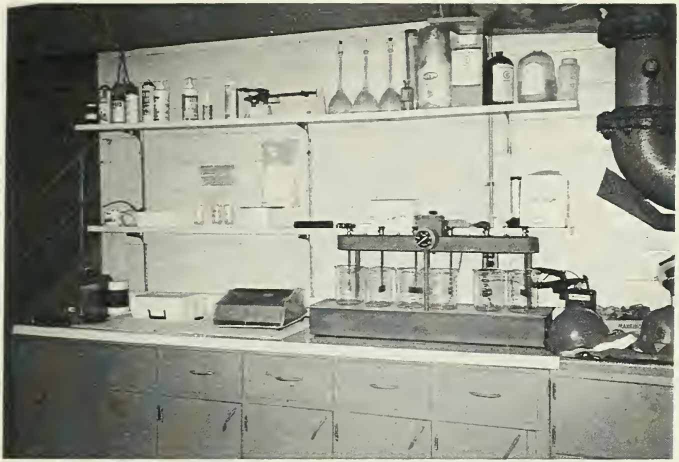
PUMP

MAKE:	DELAVAL
MODEL:	2KS514
TYPE:	HORIZONTAL SPLIT CASE
SPEED:	1450 RPM
CAPACITY:	2450 m^3/D (375 IGPM)
TDH:	83.8 m (275 FT.)

MOTOR

MAKE:	CANADIAN GENERAL ELECTRIC
MODEL:	8F1255 INDUCTION
TYPE:	K
SERIAL NUMBER:	710905
POWER:	3 PHASE/60 CYCLES/58 AMPS/60 HP
SPEED:	1765 RPM
FRAME:	444

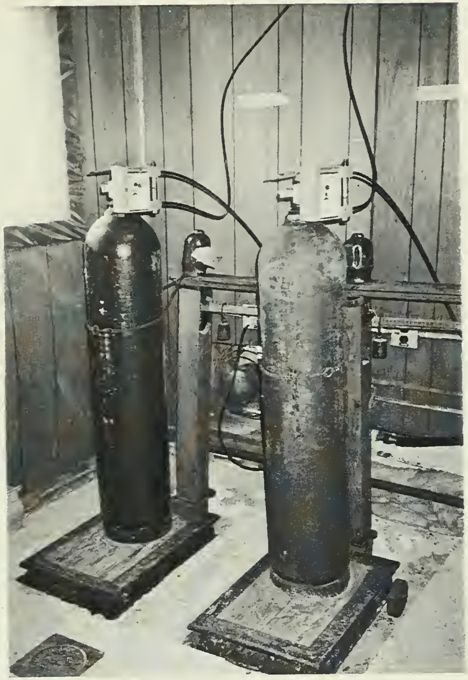
LABORATORY FACILITY



JAR TESTING EQUIPMENT

PRE-CHLORINE ROOM

PRE-CHLORINATION FACILITY



MAKE: CAPITAL CONTROL CO.
CAPACITY: 11.3 KG/DAY (25 lb/DAY)
MODEL: 201
SERIAL NUMBER: CEO 880/4012-1 AND CEO880/4012-2
3 PRE-CHLORINATORS - 1 FOR NEW PLANT
1 FOR OLD PLANT
1 FOR STANDBY

POST-CHLORINATOR

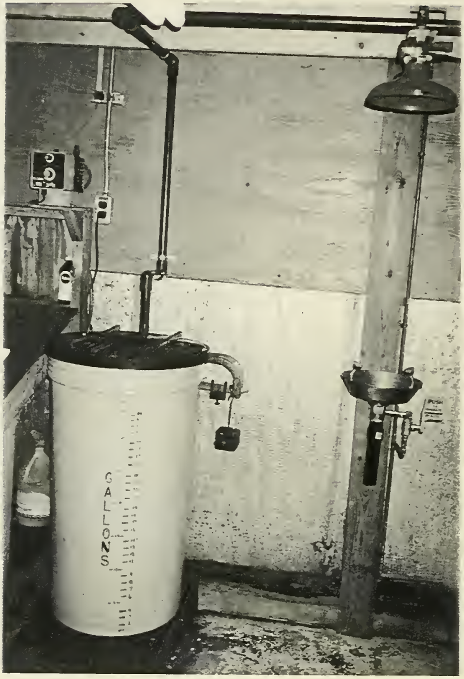
MAKE:	WALLACE & TIERNAN
MODEL:	500 LBS. SERIES V800
TYPE:	V NOTCH
SERIAL NUMBER:	LDC 10652 A831
POWER:	115 VOLT 1 PHASE

POST-CHLORINE RESIDUAL ANALYZER

MAKE:	WALLACE & TIERNAN
MODEL:	
SERIAL NUMBER:	A767014 XX 24976
POWER:	115 VOLT/60 CYCLES

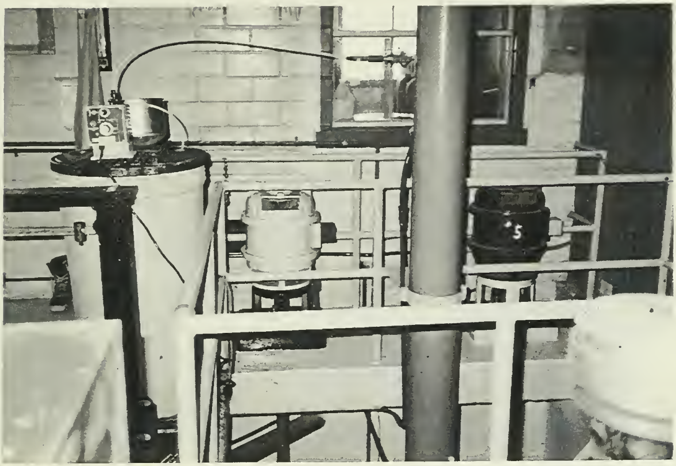
OUT OF SERVICE

NEW PLANT - LIQUID PAC APPLICATION



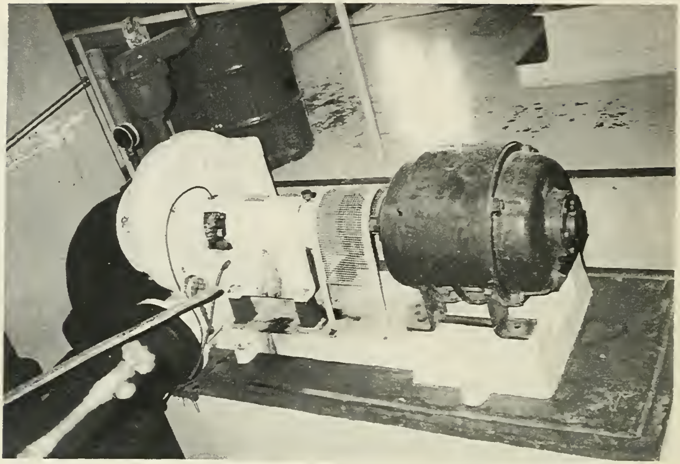
MAKE: LIQUID METRONICS INC.
MODEL: D731-20
SERIAL NUMBER: 84 021894
MAXIMUM OUTPUT: 1.1 m^3/D (240 GPD)

OLD PLANT LIQUID PAC APPLICATION



MAKE:	LIQUID METRONICS INC.
MODEL:	B721-91S C
SERIAL NUMBER:	86120458
MAXIMUM OUTPUT:	273 LITRES/DAY (60 GPD)

BACKWASH PUMP



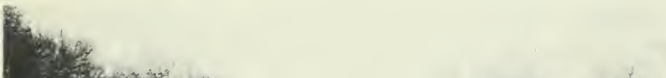
PUMP:

MAKE:	SMART TURNER
MODEL:	8JUUF
SPEED:	750 RPM
CAPACITY:	11 765 m^3/d (1800 IGPM)
HEAD:	6.1 m (20 FT.)

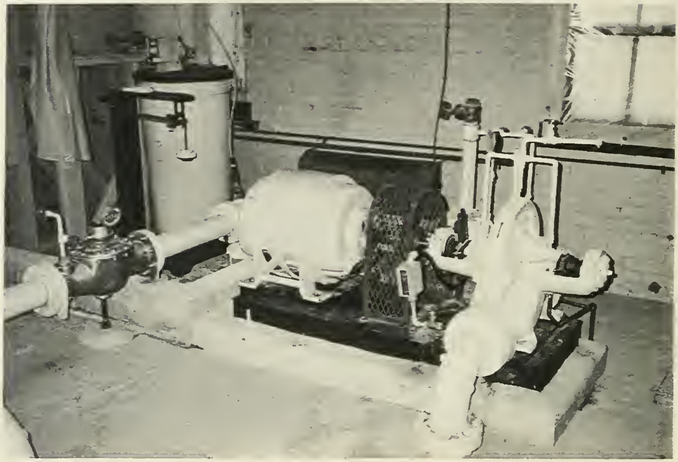
MOTOR:

MAKE:	GENERAL ELECTRIC
MODEL:	8F 1729
FRAME:	404
SERIAL NUMBER:	712012
POWER:	20 HP/550 V/60 CYCLES/3-PHASE
SPEED:	875 RPM

DOAN'S HOLLOW INFILTRATION GALLERY



DOAN'S HOLLOW PUMP



PUMP

MAKE:	BABCOCK CENTRIFUGAL
SERIAL NUMBER:	1140
SPEED:	450 RPM
CAPACITY:	2290 m^3/d (350 IGPM)
TDH:	45.7 m (150 ft.)

MOTOR

MAKE:	GENERAL ELECTRIC
MODEL:	559R1229
SERIAL NUMBER:	2930 V
SPEED:	1750 RPM
POWER:	25 HP/550 V/60 CYCLES/3 PHASE/25 AMPS
FRAME:	405

CHLORINE FACILITY

MAKE:	LIQUID METRONICS
MODEL:	A121-91T
SERIAL NUMBER:	84101774
MAXIMUM OUTPUT:	109 Litres/day (24 gpd)